UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
PREVENTION, PESTICIDES
AND TOXIC SUBSTANCES

Note to Reader

Background: As part of its effort to involve the public in the implementation of the Food Quality Protection Act of 1996 (FQPA), which is designed to ensure that the United States continues to have the safest and most abundant food supply. EPA is undertaking an effort to open public dockets on the organophosphate pesticides. These dockets will make available to all interested parties documents that were developed as part of the U.S. Environmental Protection Agency's process for making reregistration eligibility decisions and tolerance reassessments consistent with FQPA. The dockets include preliminary health assessments and, where available, ecological risk assessments conducted by EPA, rebuttals or corrections to the risk assessments submitted by chemical registrants, and the Agency's response to the registrants' submissions.

The analyses contained in this docket are preliminary in nature and represent the information available to EPA at the time they were prepared. Additional information may have been submitted to EPA which has not yet been incorporated into these analyses, and registrants or others may be developing relevant information. It's common and appropriate that new information and analyses will be used to revise and refine the evaluations contained in these dockets to make them more comprehensive and realistic. The Agency cautions against premature conclusions based on these preliminary assessments and against any use of information contained in these documents out of their full context. Throughout this process, If unacceptable risks are identified, EPA will act to reduce or eliminate the risks.

There is a 60 day comment period in which the public and all interested parties are invited to submit comments on the information in this docket. Comments should directly relate to this organophosphate and to the information and issues available in the information docket. Once the comment period closes, EPA will review all comments and revise the risk assessments, as necessary.

These preliminary risk assessments represent an early stage in the process by which EPA is evaluating the regulatory requirements applicable to existing pesticides. Through this opportunity for notice and comment, the Agency hopes to advance the openness and scientific soundness underpinning its decisions. This process is designed to assure that America continues to enjoy the safest and most abundant food supply. Through implementation of EPA's tolerance reassessment program under the Food Quality Protection Act, the food supply will become even safer. Leading health experts recommend that all people eat a wide variety of foods, including at least five servings of fruits and vegetables a day.

Note: This sheet is provided to help the reader understand how refined and developed the pesticide file is as of the date prepared, what if any changes have occurred recently, and what new information, if any, is expected to be included in the analysis before decisions are made. **It is not meant to be a summary of all current information regarding the chemical.** Rather, the sheet provides some context to better understand the substantive material in the docket (RED chapters, registrant rebuttals, Agency responses to rebuttals, etc.) for this pesticide.

Further, in some cases, differences may be noted between the RED chapters and the Agency's comprehensive reports on the hazard identification information and safety factors for all organophosphates. In these cases, information in the comprehensive reports is the most current and will, barring the submission of more data that the Agency finds useful, be used in the risk assessments.

Jack E. Housenger, Acting Director
Special Review and Reregistration Division

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

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OFFICE OF
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AND TOXIC SUBSTANCES

March 23, 2000

MEMORANDUM

SUBJECT: OCCUPATIONAL AND RESIDENTIAL EXPOSURE ASSESSMENT AND RECOMMENDATIONS FOR THE REREGISTRATION ELIGIBILITY DECISION DOCUMENT FOR DIAZINON

FROM: Julianna F. Cruz, IHIT, CHMM
Reregistration Branch 3
Health Effects Division (7509C)

TO: Ben Chambliss, CRM
Special Review and Reregistration Division (7508C)

and

Catherine Eiden, Chemist
Reregistration Branch 3
Health Effects Division (7509C)

THRU: Steven A. Knizner, Branch Senior Scientist
Risk Characterization and Analysis Branch
Health Effects Division (7509C)

Please find attached the revised occupational and residential exposure assessment for diazinon.

The following revisions were based on and made within this exposure assessment as follows:

1) Data from various chemical specific exposure studies, and the registrants own risk assessments were incorporated(MRID Nos. 402029-02; 404666-01(corrected residue levels based on two sided leaf surface areas and then adjusted their corresponding exposures/doses, and MOEs); 443488-01, -02, -03, -04, & -06; and 449591-01.);

2) Comments (Dated February 09, 2000) submitted by the registrant were considered and incorporated when appropriate [e.g., lower acreage adjustments were made to the acreage treated per day for the occupational scenarios (4f-hand gun lawn sprayer; 7 a & b -low pressure hand-wand & backpack sprayer; 8- low pressure hand-wand; and 9 a & b- belly grinder & push-type-spreader); all inhalation exposure scenarios (μg to mg), removal of various scenarios for which no

uses exist (e.g., granular- loading/application for aerial, flagging and hand type scenarios), etc..]; and
3) removal of the helicopter mixer/loader and application scenarios based on Exposure SAC policy.

DP Barcode:	D261622\D264918
Pesticide Chemical Codes:	057801
EPA Reg Nos:	100-469 (G), 100-460 (WP), 100-258, 100-468 (G), 100-770 (SC), 100-784 (EC), 100-460 (WP), 100-463 (EC), 100-461 (EC)
EPA MRID No.:	402029-02; 404666-01; 443488-01, -02, -03, -04, & -06; and 449591-01
PHED:	Yes, Version 1.1

cc: Chron F, Chem F, J. Cruz, B. Chambliss (PM51, SRRD)
RDI: SVH: 5/7/98

I. EXECUTIVE SUMMARY

Occupational/Residential Exposure and Risk Estimates:

HED has conducted a risk assessment for occupational and residential (non-occupational) exposure scenarios resulting from diazinon's registered uses. A margin of exposure (MOE) greater than 100 for short- term, intermediate-term, and long-term dermal occupational and residential exposures to diazinon does not exceed HED's level of concern. For occupational and residential inhalation exposures of any duration, a MOE of greater than 300 does not exceed HED's level of concern. Because dermal and inhalation risk assessments have different levels of concern (MOEs of 100 and 300 respectively) the Aggregate Risk Index (ARI) approach is necessary for aggregating dermal and inhalation risk estimates. An ARI of greater than 1 does not exceed the Agency's level of concern.

Residential Risk Estimates:

Handler - Residential handler risk estimates exceed HED's level of concern. Residential handler exposure is considered short-term. No chemical specific exposure data were available to estimate handler exposures to diazinon for typical homeowner uses. In the absence of chemical specific exposure data, HED uses the Residential Standard Operating Procedures (SOPs - December 1997). All MOEs are less than 100 for dermal and 300 for inhalation; which exceed HED's level of concern for residential handler exposures. HED anticipates that aggregating exposures, dermal plus inhalation, for residential handlers would only result in risk estimates that would further exceed HED's level of concern.

Post-application Dermal and Inhalation Exposures - Risk estimates for these potential exposure scenarios indicate that all post-application residential exposures lead to risk estimates above HED's level of concern, **except** for granular turf use scenarios. No chemical specific exposure data were available to estimate post-application exposure to diazinon following typical residential uses, **except** for indoor inhalation exposures from crack and crevice indoor applications. Therefore, HED used the Revised Residential Standard Operating Procedures (SOPs - November 1999), to calculate post-application dermal exposures. The maximum lawn treatment rate and various indoor application rates were used. Adults and toddler exposures were assessed. Toddlers are the most highly exposed subgroup following lawn and carpet treatments through direct dermal exposures (crawling) and oral exposures (hand-to-mouth).

Combined post-application risk estimates from the turf granular formulation , are as follows:

Total combined toddler exposure risk estimates are from dermal, non-dietary, and inhalation; which do not exceed HED's level of concern **(ARI = 1.3)**

Total combined adult exposure risk estimates are from dermal, and inhalation; which do not exceed HED's level of concern **(ARI = 2.7)**

Occupational Risk Estimates:

Applicator/Mixer/Loader - HED has concerns regarding occupational exposures and risk estimates for a number of application exposure scenarios for pesticide handlers. No chemical specific exposure data were available for the exposure assessments for mixer/loader/applicators (handlers). Short-term and intermediate-term dermal and inhalation exposure assessments were made using the Rapid Exposure and Risk Assessment Tool (RERAT) to estimate risk using 27 occupational exposure scenarios for which surrogate exposure data exist. All scenarios used apply to the registered uses of diazinon. The estimated risks consider maximum mitigation, i.e., baseline clothing, additional personal protective equipment (PPE) including a double layer of clothing and gloves, and engineering controls (closed application and mixing systems).

Of the 27 occupational exposure scenarios identified, for short-term dermal exposures, 1 scenario using baseline protection, 7 scenarios using additional PPE, and 8 scenarios using engineering controls have dermal MOEs greater than 100. None of the exposure scenarios for mixing/loading with wettable powders have MOEs greater than 100. For intermediate-term dermal exposure, only 1 scenario with engineering controls have risk estimates (MOEs) greater than or equal to 100. For inhalation exposures, 2 scenarios using baseline protection, 16 scenarios using additional PPE, and 14 scenarios using engineering controls have MOEs greater than 300. Once inhalation and dermal exposures are combined using the Aggregate Risk Index (ARI), regardless of duration, all exposure scenarios exceed HED's level of concern, because the dermal risk estimates are less than 100, except for 16 scenarios (ARIs are equal to or greater than 1). There are some potential long-term occupational exposures expected to occur for the registered uses of diazinon. However, risk estimates for these scenarios are addressed by the intermediate-term risk estimates because the same toxicological endpoint used for the intermediate-term occupational risk assessment is used for the chronic risk assessment. Only one aggregate risk estimate (Scenario # 3-Loading granules for tractor-drawn broadcast spreaders), has an ARI above 1 (2.8); which does not exceed HED's level of concern.

Post-application Dermal Exposure - HED has concerns over short- and intermediate-term post-application dermal exposures. However, for workers re-entering greenhouses, dermal and inhalation exposures are of concern. All dermal and inhalation exposure estimates exceed HED's level of concern. Short- and intermediate-term post-application worker exposures may occur dermally (which are outdoor activities), but not through inhalation [except for workers re-entering greenhouses(which are indoor activities)]. Chemical specific post-application exposure data are available as follows:

Agricultural:

MRID Study Nos. 402029-02, & -03, and 404666-01: Chemical specific data are available for tree crops (oranges) and cabbage. Data on citrus was used to estimate post-application exposure for tree crops, and once adjusted for differences in application rate, they were used to estimate post-application exposures for grapes. MOEs for short- and intermediate-term exposures, defined as exposures from 1 to 7 days and 1 to several weeks, respectively. For tree crops, based on the maximum application rate (3 lb ai/A), intermediate-term MOEs are **less than 4.8** for residues greater than or equal to the limit of detection (LOD). Dislodgeable foliar residue (DFR) values for tree crops reach the LOD (0.004 $\mu g/cm^2$) 12 days after treatment. Extrapolating, DFR values for tree crops reach ½ the LOD (0.002 $\mu g/cm^2$) for tree crops 15 days after treatment, and the

MOE is **6.2**. For grapes, based on the maximum application rate (1 lb ai/A), short- and intermediate-term MOEs **are less than 31, and 3 respectively**, for residues greater than or equal to the LOD. DFR values for grapes reach the LOD (0.004 $\mu g/cm^2$) 8 days after treatment. Extrapolating, DFR values for grapes reach ½ the LOD (0.002 $\mu g/cm^2$) for grapes 11 days after treatment, and the intermediate-term MOE is **5.6**. For cabbage, based on the typical mid-range application rate (2 lbs ai/A), MOEs for intermediate-term exposures are **less than 30** for residues greater than or equal to the LOD. DFR values for cabbage reach the LOD (0.002 $\mu g/cm^2$) 13-14 days after treatment. Extrapolating, DFR values for cabbage reach ½ the LOD (0.001 $\mu g/cm^2$) 16 days after treatment, and the MOE **is 62**.

Essentially, for all post-application dermal exposure scenarios associated with tree crops and grapes, DFR levels must be extrapolated below ½ of the LOD before MOEs greater than or equal to 100 can be achieved. For low-growing crops at an application rate 2 lbs. ai/A, a MOE of **71** is achieved for short-term dermal exposures, 7 days after treatment, and a MOE of **140** is achieved for intermediate-term dermal exposures 19 days after treatment. **A REI has been set for three days after treatment (MOE = 170) for low exposure potential crops at the minimum application rate of 0.25 lb ai/A**. DFR values at ½ of the LOD and associated days after treatment (DAT) have been high-lighted in Table 8.

The reentry interval (REI) on current diazinon labels (e.g., EPA Reg. No. 100-460) is 24 hours for fruit and nut crops, vegetable crops, and field crops, and 12 hours for ornamentals. California requires a REI of 5 days for some crops. The significant difference between the current REI on the diazinon labels (24 hours) and that listed for California (5 days for some crops) and the REIs presented in this document is attributed to HED's use of plasma ChE as the toxicological endpoint (i.e., 0.25 mg/kg/day for short-term exposures, and 0.02 mg/kg/day for intermediate-term exposures, and an uncertainty factor of 100).

Uncertainties in this analysis include: the use of 100 percent dermal absorption; the use of a linear extrapolation applied to the DFR values from the study application rate (1 lb ai/A) to the maximum labeled rate (3 lbs ai/A) for tree crops; and the use of the citrus DFR values once adjusted for differences in application rates between citrus and grapes to estimate exposure from grapes. The use of 100 percent dermal absorption may overestimate the risks. The effect of extrapolating the citrus DFR data to a higher application rate and using it to represent grape leaves is unknown and may under- or overestimate the actual residue levels. An acceptable dermal absorption study would allow refinement of the dermal exposure and risk estimates.

<u>Greenhouses:</u>

MRID Study Nos. 443488-02, -03, -04, & -06: Based on some chemical specific data, and information provided by the registrant, it is **estimated** that all dermal and inhalation exposures to workers re-entering greenhouses after treatment with diazinon type products, exceed HED's level of concern; until 8-10 days after application, at a rate of 0.58 lb ai/A, would result in ARIs greater than or equal to 1.

Data Requirements:

Occupational Exposure - The following mixer/loader/applicator data requirements were identified to support reregistration of diazinon:

1) Guideline 231 - Estimation of Dermal Exposure at Outdoor Sites (studies are required for handlers in double-layer body protection and chemical-resistant gloves and additional studies are required for handlers using engineering controls.
   -mixing/loading with granule formulations and emulsifiable concentrates.
   -broadcast and banding application of granule formulations.
   -application of liquids with various types of equipment (e.g. aerial, airblast, rights-of-way-sprayer, etc.).

2) Guideline 232 - Estimation of Inhalation Exposure at Outdoor Sites (studies are required for handlers wearing respirators and additional studies are required for handlers using engineering controls.)
   -mixing/loading with granule formulations and emulsifiable concentrates.
   -broadcast and banding application of granule formulations.
   -application of liquids with various types of equipment (e.g. aerial, airblast, rights-of-way-sprayer, etc.).

Based on the use information and data available, the following post-application exposure data are required [for workers performing ornamental greenhouse activities (e.g., cut/harvest and pruning), contacting soil, seeds and animals treated with diazinon] to support the reregistration of diazinon:

1) 132-1(a) foliar dislodgeable residue dissipation (for greenhouse ornamentals),

2) 132-1(b) soil residue dissipation,

3) 133-3 dermal exposure, and

4) 133-4 inhalation exposure: for the uses that may involve greenhouse indoor activities, and human contact with treated soil which include: pre-planting on strawberries, cabbage, turnips, tomatoes, sweet potatoes, radishes, lettuce, cucumbers, etc., and repeated foliar applications within a greenhouses to, ornamental non-flowering plants, ornamental herbaceous plants, ornamental woody shrubs and vines, and all nursery stock. Data are required using both the liquid and granule formulations.

5) There are no chemical specific exposure data for handling diazinon treated soil, seed/seedling treatments and sheep treatments; therefore the Agency is requiring data and/or further clarification of the use patterns involving workers handling or working with or in the treated soil, seed/seedling treatments and sheep treatments which may result in post-application exposure. These soil treatment uses are on strawberries, cabbage, turnips, tomatoes, sweet potatoes, radishes, lettuce, cucumbers, etc.

II. Exposure Assessment Estimates for Occupational and Non-occupational (Residential) Scenarios and Their Risk Characterization

(a). General Assumptions

EPA has determined that there are potential short-, and intermediate-term exposure scenarios for mixer/loaders, applicators, and mixer/loader/applicators during usual use patterns associated with diazinon. Based on the use patterns, 27 major occupational exposure scenarios were identified for handlers, and 4 (3-for agriculture activities and 1-for greenhouse activities) major exposure scenarios were identified for postapplication exposure. For homeowners, 7 major residential exposure scenarios for homeowner handlers were identified, and 20 [8 (outdoor) turf (4 from liquid formulations, and 4 from granular formulations); and 12 (indoor) from Pest Control Operator Crack & Crevice applications)] major postapplication exposure scenarios were also identified.

For all occupational risk assessments, the adult body weight was assumed to be 70 kg. For all residential risk assessments, a 70 kg adult body weight and a 15 kg body weight for 3 year old toddlers were assumed. Dermal and inhalation exposures are assumed to occur for adults under both occupational and residential exposure scenarios. However, only short-term dermal or short-term, inadvertent oral (hand-to-mouth) exposures are assumed to occur for children under the residential exposure scenario.

The following toxicological endpoints were used to estimate occupational and residential risks: for short-term dermal exposures, an oral NOAEL of 0.25 mg/kg/day; for intermediate- and long-term dermal exposures, an oral NOAEL of 0.02 mg/kg/day; and for inhalation exposures (all time periods) an inhalation LOAEL of 0.026 mg/kg/day. The assessment assumes 100% absorption through both dermal and inhalation exposure routes. Target margins of exposure (MOEs) for short- and intermediate-term dermal risk assessments are 100 resulting from the following uncertainty factors: a 10x for interspecies variability and 10x for intra-species extrapolation. For inhalation risk assessments (all time periods) the target MOE is 300x resulting from uncertainty factors for interspecies variability (10x), intra-species extrapolation (10x), and for lack of a NOAEL in the critical study and consequent use of a LOAEL (3x).

Data quality is a critical parameter in the interpretation of the results of any exposure assessment. No chemical specific mixer/loader/applicator exposure data were available from the registrant to be used in supporting the reregistration of diazinon. Handler exposure risk assessments were conducted using the surrogate data from the PHED data base (Version 1.1). Data contained in PHED are assigned grades (A through E) based on the overall quality of the analytical recovery data generated concurrently with actual data points (i.e., laboratory recovery, field recovery and stability data). All exposure assessments using PHED were based on the surrogate unit exposure values currently being used as a standard source of exposure values, and the use data presented by the registrant. Values were defined using high quality data and a large number of replicates to calculate exposures if the data were available. However, if not available, rangefinder exposure values were calculated using all data available in PHED.

In general, for PHED data, "Best Available" grades are defined by Exposure Scientific Advisory

Council (SAC) SOP for meeting Subdivision U Guidelines. Best available grades are assigned as follows: matrices with grades A and B data and a minimum of 15 replicates; if not available, then grades A, B, and C data and a minimum of 15 replicates; if not available, then all data regardless of the quality and number of replicates. Data confidence are assigned as follows:

High = grades A and B and 15 or more replicates per body part
Medium = grades A, B, and C and 15 or more replicates per body part
Low = grades A, B, C, D, and E or any combination of grades with less than 15 replicates

(b). Occupational Mixer/Loader/Handler/Applicator Exposure and Assumptions

Exposure data requirements are triggered based on the potential for exposure and the toxicological profile of the active ingredient. Exposure analyses for the use/activity patterns associated with diazinon have been completed for each handler (i.e., mixer/loader/applicator) scenario of concern to the Agency and data gaps for specific exposure scenarios have been identified.

Occupational exposures can potentially occur to pesticide handlers, mixers, loaders, and applicators working with diazinon from a multitude of application techniques and multiple formulations (e.g., liquids and solids). Diazinon treatments include, but are not limited to, aerial applications, airblast, groundboom, tractor and push-type granular spreaders, and handheld spray equipment. Occupational exposure to diazinon residues can occur to post-application workers during harvesting activities.

Major occupational exposure scenarios (27) are given below:

Occupational Handler scenarios are as follows:

1a. Mixing/loading liquids to support aerial/chemigation applications.
Short-, and intermediate-term use patterns.
1b. Mixing/loading liquids to support groundboom applications.
Short-, and intermediate-term use patterns.
1c. Mixing/loading liquids to support airblast applications.
Short-, and intermediate-term use patterns.
1d. Mixing/loading liquids to support rights-of-way-sprayer applications.
Short-, intermediate-, and long- term use patterns.*
1e. Mixing/loading liquids to support high-pressure hand-wand (livestock areas) applications.
Short-, intermediate-, and long- term use patterns.*
2a. Mixing/loading wettable powders to support aerial/chemigation applications.
Short-, and intermediate-term use patterns.
2b. Mixing/loading wettable powders to support groundboom applications.
Short-, and intermediate-term use patterns.
2c. Mixing/loading wettable powders to support airblast applications.
Short-, and intermediate-term use patterns.
2d. Mixing/loading wettable powders to support rights-of-way-sprayer applications.

Short-, intermediate-, and long- term use patterns.*

2e. Mixing/loading wettable powders to support high-pressure handwand (livestock areas) applications. *Short-, intermediate-, and long- term use patterns*.*

3. Loading granules to support tractor-drawn broadcast spreaders applications
Short-, and intermediate-term use patterns.

4a. Applying sprays with an airblast. *Short-, and intermediate-term use patterns.*

4b. Applying sprays with groundboom. *Short-, and intermediate-term use patterns.*

4c. Applying liquid with a paintbrush. *Short-, intermediate-, and long-term use patterns*.*

4d. Applying sprays with an airless sprayer. *Short-, and intermediate-term use patterns.*

4e. Applying sprays with a high-pressure handwand (livestock areas).
Short-, intermediate-, and long-term use patterns.*

4f. Applying sprays with a handgun (lawn).
Short-, intermediate-, and long-term use patterns.*

4g. Applying sprays with a rights-of-way sprayer.
Short-, intermediate, and long-term use patterns.*

4h. Applying sprays with a fixed-wing aircraft. *Short-, and intermediate-term use patterns.*

5. Applying granules with a tractor drawn spreader.
Short-, and intermediate-term use patterns.

6. Flagging for sprays. *Short-, and intermediate-term use patterns.*

7a. Mixing/loading/applying liquids with a low pressure hand-wand.
Short-, intermediate, and long-term use patterns.*

7b. Mixing/loading/applying liquids with a backpack sprayer.
Short-, intermediate, and long-term use patterns.*

7c. Mixing/loading/applying liquids with a high pressure hand-wand (greenhouse).
Short-, intermediate, and long-term use patterns.*

8. Mixing/loading/applying wettable powders with a low pressure hand-wand.
Short-, intermediate, and long-term use patterns.*

9a. Loading/applying granules with a belly grinder.
Short-, and intermediate-term use patterns.

9b. Loading/applying granules with a push-type spreader.
Short-, and intermediate-term use patterns.

Use scenarios noted with an asterisk (*) have the potential for long-term exposures. Potential risks from any long-term exposures that may occur under these use scenarios are adequately addressed by the intermediate-term exposure assessment because both risk assessments use the same dermal and inhalation toxicological endpoint. There are no exposure data (chemical specific or PHED) available for this chemical for seed/seedling treatments and sheep treatments.

Table 1 gives the standard (default) number of acres treated that was used by HED to estimate daily exposure levels in each occupational handler scenario.

Table 1 . Occupational Handler Standard (Default) Daily Area(s) Treated per Scenario for Diazinon		
Exposure Scenario and Equipment / Usage	***Value***	***Units***
Mixer/Loader		
Scenario # 1 Mixing/loading liquids		
a) Aerial / Chemigation	350	Acres per day
b) Groundboom	80	Acres per day
c) Airblast	40	Acres per day
d) Rights-of-Way Sprayer	40	Acres per day
e) High-pressure Handwand (Livestock Areas)	1000	Gallons per day
Scenario # 2 Mixing/loading wettable powders		
a) Aerial / Chemigation	350	Acres per day
b) Groundboom	80	Acres per day
c) Airblast	40	Acres per day
d) Rights-of-Way Sprayer	40	Acres per day
e) High-pressure Handwand (Livestock Areas)	1000	Gallons per day
Scenario # 3 Loading granules		
Tractor-drawn broadcast spreaders	80	Acres per day
Applicators		
Scenario # 4 Applying sprays		
a) Airblast	40	Acres per day
b) Groundboom	80	Acres per day
c) Paintbrush	5	Gallons per day
d) Airless Sprayer	40	Gallons per day
e) High-pressure Handwand (Livestock Areas)	1000	Gallons per day
f) Handgun (lawn) Sprayer	3	Acres per day
g) Rights-of-Way Sprayer	40	Acres per day
h) Fixed-wing Aircraft	350	Acres per day

Table 1 . Occupational Handler Standard (Default) Daily Area(s) Treated per Scenario for Diazinon		
Exposure Scenario and Equipment / Usage	***Value***	***Units***
Scenario # 5 Applying granules		
Tractor-drawn broadcast spreaders	80	Acres per day
Scenario # 6 Flagging (In support of aerial application)		
Sprays	350	Acres per day
Mixer/Loader/Applicator		
Scenario # 7 Mixing/loading/applying liquids		
a) Low Pressure Handwand	1	Acres per day
b) Backpack sprayer	1	Acres per day
c) High pressure handwand (greenhouse)	1000	Gallons per day
Scenario # 8 Mixing/loading/applying wettable powders		
Low pressure handwand	1	Acres per day
Scenario # 9 Loading/applying granules		
a) Belly Grinder	1	Acres per day
b) Push-type spreader	3	Acres per day

Potential daily exposure is calculated using the following formula:

Daily Exp. (mg ai/day) = Unit Exp. (mg ai/lb ai) x Max. Appl. Rate (lb ai/acre) x Max. Area Treated (acres/day)

The daily dose is calculated using the following formula:

Daily Dose (mg ai/kg/day) = Daily Exp. (mg ai/day)/ body weight (kg)

These calculations of daily exposure and dose of diazinon received by handlers and homeowners are used to assess the dermal risk to those handlers and homeowners. The short-term and intermediate-term MOEs were calculated using the following formula:

MOE = NOAEL (mg/kg/day)/ Daily Dose (mg/kg/day)

Tables 2 (a-c) provide estimates of daily unit dermal and inhalation exposures for three levels of protective equipment for the major exposure and use scenarios. Table 2(a) provides dermal and inhalation exposure estimates for baseline protection, which includes a single layer of clothing including long pants, a long-sleeved shirt, and no gloves. Table 2(b) provides dermal and inhalation exposure estimates for additional personal protective equipment (PPE), which includes wearing coveralls over a single layer of clothing and chemical-resistant gloves. Table 2(c) provides dermal and inhalation exposure estimates through the use of engineering controls, which refers to the use of a single layer of clothing and closed mixing systems and closed-cab tractors. The tables also provide the PHED parameters and caveats specific to each exposure scenario. Comments at the bottom of each table include any other critical descriptions of the data including information pertaining to the quality of the exposure data, level of confidence, and any protection factors applied to the exposure data.

Table 2a. Diazinon Baseline Occupational PHED Unit Exposures [a]

Exposure Scenario Equipment / Usage	Dermal Unit Exposure (mg/lb ai) (dermal+hands)	Dermal Data Confid.	Dermal Grades	Dermal Repli.	Hand Grade	Hand Repli.	Clothing Scenario [b]	Inhalation Unit Exposure (ug/lb ai)	Inhalation Data Confid.	Inhalation Grades	Inhalation Repli.
Mixer/Loader											
Scenario # 1 Mixing/loading liquids											
a) Aerial / Chemigation b) Groundboom c) Airblast d) Rights-of-Way Sprayer e) High-pressure Handwand (Livestock Areas)	2.9	High	AB	72-122	AB	53	LSS, LP, NG	1.2	High	AB	85
Scenario # 2 Mixing/loading wettable powders											
a) Aerial / Chemigation b) Groundboom c) Airblast d) Rights-of-Way Sprayer e) High-pressure Hand-wand (Livestock Areas)	3.7	Low	ABC	22- 45	ABC	7	LSS, LP, NG	43	Medium	ABC	44
Scenario # 3 Loading granules											
Tractor-drawn broadcast spreaders	0.0084	Low	ABC	33-78	All	10	LSS, LP, NG	1.7	High	AB	58
Applicator											
Scenario # 4 Applying sprays / liquids											
a) Airblast	0.36	High	AB	32-49	AB	22	LSS,LP,NG	4.5	High	AB	47
b) Groundboom	0.014	High	AB	23-42	AB	29	LSS,LP,NG	0.74	High	AB	22
c) Paintbrush	180	Low	C	14-15	B	15	LSS,LP,NG	280	Medium	C	15

Table 2a. Diazinon Baseline Occupational PHED Unit Exposures [a]											
Exposure Scenario Equipment / Usage	**Dermal Unit Exposure (mg/lb ai) (dermal+hands)**	**Dermal Data Confid.**	**Dermal Grades**	**Dermal Repli.**	**Hand Grade**	**Hand Repli.**	**Clothing Scenario [b]**	**Inhalation Unit Exposure (ug/lb ai)**	**Inhalation Data Confid.**	**Inhalation Grades**	**Inhalation Repli.**
d) Airless Sprayer	38	High	B	15	B	15	LSS,LP,NG	830	Medium	C	15
e) High-pressure Hand-wand (Livestock.Areas.)	1.8	Low	All	9-11	All	2	LSS,LP,NG	79	Low	All	11
f) Handgun (lawn) Sprayer	0.77	Low	C	0-14	C	14	LSS,LP,NG	1.4	Low-M	AB	14
g) Rights-of-Way Sprayer	1.3	Low	ABC	4-30	AB	16	LSS,LP,NG	3.9	High	A	16
h) Fixed-wing Aircraft	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Scenario # 5 Applying granules											
Tractor-drawn broadcast spreaders	0.0099	Low	AB	1-5	AB	5	LSS,LP,NG	1.2	Low	AB	5
Scenario # 6 Flagging (In support of aerial application)											
Sprays	0.011	High	AB	18-28	AB	30	LSS,LP,NG	0.35	High	AB	28
Mixer/Loader/Applicator											
Scenario # 7 Mixing/loading/applying liquids											
a) Low Pressure Hand-wand	100	Low	ABC	9-80	All	70	LSS,LP,NG	30	Medium	ABC	80
b) Backpack sprayer	2.5	Low	AB	9-11	C	11	LSS,LP,NG	30	Low	A	11
c) High pressure hand-wand (greenhouse)	3.5	Low	AB	7-13	C	13	LSS,LP,NG	120	Low	A	13
Scenario # 8 Mixing/loading/applying wettable powders											
Low pressure hand-wand	8.6	Medium	ABC	16	AB	15	LSS,LP,NG	1100	Medium	ABC	16
Scenario # 9 Loading/applying granules											
a) Belly Grinder	10	Medium	ABC	29-45	ABC	23	LSS,LP,NG	62	High	AB	40
b) Push-type spreader (no head & neck data available)	2.9	Low	C	0-15	C	15	LSS,LP,NG	6.3	High	B	15

[a] The Pesticide Handler Exposure Database (PHED) Version 1.1

[b] Baseline Dermal Unit Exposure is based on workers wearing long sleeve shirts and long pants, and no gloves (LSS, LP, NG);
open mixing/loading; and open cab tractor; except for backpack sprayers. Chemical resistant gloves are included for the backpack assessment because the no glove scenario is not available. Baseline data are not available for aerial application. Baseline inhalation exposure represents no respirator.

NF = Not Feasible; **ND** = No Data

Table 2b. Diazinon Maximum PPE PHED Unit Exposures [a]											
Exposure Scenario Equipment / Usage	**Dermal Unit Exposure (mg/lb ai) (dermal+hands)**	**Dermal Data Confid.**	**Dermal Grades**	**Derm. Repli.**	**Hand Grade**	**Hand Repli.**	**Clothing Scenario [b]**	**Inhalatn. Unit Exposure (ug/lb ai)**	**Inhalatn. Data Confid.**	**Inhalatn. Grades**	**Inhalatn. Repli.**
Mixer/Loader											
Scenario # 1 Mixing/loading liquids											
a) Aerial / Chemigation b) Groundboom c) Airblast d) Rights-of-Way Sprayer e) High-pressure Hand-wand (Livestk. Areas)	**0.017**	**High**	**AB**	**72- 122**	**AB**	**59**	**DLC, CRG**	**0.24**	**High**	**AB**	**85**
Scenario # 2 Mixing/loading wettable powders											
a) Aerial / Chemigation b) Groundboom c) Airblast d) Rights-of-Way Sprayer e) High-pressure Handwand (Livestk Areas)	**0.13**	**Medium**	**ABC**	**22- 45**	**ABC**	**24**	**DLC, CRG**	**8.6**	**Medium**	**ABC**	**44**
Scenario # 3 Loading granules											
Tractor-drawn broadcast spreaders	**0.0034**	**Low**	**ABC**	**12-59**	**AB**	**45**	**DLC, CRG**	**0.34**	**High**	**AB**	**58**
Applicator											
Scenario # 4 Applying sprays / liquids											
a) Airblast	**0.22**	**High**	**AB**	**31-48**	**AB**	**18**	**DLC, CRG**	**0.9**	**High**	**AB**	**47**
b) Groundboom	**0.011**	**Medium**	**AB**	**23-42**	**ABC**	**21**	**DLC, CRG**	**0.15**	**High**	**AB**	**22**
c) Paintbrush	**22**	**Low**	**C**	**14-15**	**AB**	**15**	**DLC, CRG**	**56**	**Medium**	**C**	**15**
d) Airless Sprayer	**14**	**High**	**B**	**15**	**B**	**15**	**DLC, CRG**	**170**	**Medium**	**C**	**15**
e) High-pressure Hand-wand (Livestk Areas)	**0.36**	**Low**	**All**	**9-11**	**All**	**9**	**DLC, CRG, R**	**16**	**Low**	**All**	**11**
f) Handgun (lawn) Sprayer	**0.19**	**Low**	**C**	**0-14**	**C**	**14**	**DLC, CRG, R**	**0.28**	**Low-M**	**AB**	**14**
g) Rights-of-Way Sprayer	**0.29**	**Low**	**ABC**	**4-20**	**AB**	**4**	**DLC, CRG, R**	**0.78**	**High**	**A**	**16**
h) Fixed-wing Aircraft	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**
Scenario # 5 Applying granules											

Table 2b. Diazinon Maximum PPE PHED Unit Exposures [a]											
Exposure Scenario Equipment / Usage	**Dermal Unit Exposure (mg/lb ai) (dermal+hands)**	**Dermal Data Confid.**	**Dermal Grades**	**Derm. Repli.**	**Hand Grade**	**Hand Repli.**	**Clothing Scenario [b]**	**Inhalatn. Unit Exposure (ug/lb ai)**	**Inhalatn. Data Confid.**	**Inhalatn. Grades**	**Inhalatn. Repli.**
Tractor-drawn broadcast spreaders	**0.0042**	**Low**	**AB**	**1-5**	**AB**	**5**	**DLC, CRG, R**	**0.24**	**Low**	**AB**	**5**
Scenario # 6 Flagging (In support of aerial application)											
Sprays	**0.01**	**High**	**AB**	**18-28**	**AB**	**30**	**DLC, CRG, R**	**0.07**	**High**	**AB**	**28**
Mixer/Loader/Applicator											
Scenario # 7 Mixing/loading/applying liquids											
a) Low Pressure Handwand	**0.37**	**Low**	**ABC**	**9-80**	**ABC**	**10**	**DLC, CRG, R**	**6**	**Medium**	**ABC**	**80**
b) Backpack sprayer	**1.6**	**Low**	**AB**	**9-11**	**C**	**11**	**DLC, CRG, R**	**6**	**Low**	**A**	**11**
c) High pressure handwand (greenhouse)	**1.6**	**Low**	**AB**	**7-13**	**C**	**13**	**DLC, CRG, R**	**24**	**Low**	**A**	**13**
Scenario # 8 Mixing/loading/applying wettable powders											
Low pressure handwand	**6.2**	**Medium**	**ABC**	**16**	**AB**	**15**	**DLC, CRG, R**	**220**	**Medium**	**ABC**	**16**
Scenario # 9 Loading/applying granules											
a) Belly Grinder	**5.7**	**Low**	**ABC**	**29-45**	**All**	**20**	**DLC, CRG, R**	**12**	**High**	**AB**	**40**
b) Push-type spreader (no head & neck data available)	**0.73**	**Low**	**C**	**0-15**	**C**	**15**	**DLC, CRG, R**	**1.3**	**High**	**B**	**15**

[a] The Pesticide Handler Exposure Database (PHED) Version 1.1

[b] Additional Personal Protective Equipment (PPE) to reduce dermal exposures = workers wear coveralls over single layer clothing and chemical resistant gloves [Double Layer Clothing with Chemical Resistant Gloves (DLC, CRG)]. PPE data are not available for aerial application. PPE inhalation unit exposure represents use of a respirator (R) = dust/mist respirator applied to the baseline unit exposure (Decreases the baseline unit exposure by 80%, if and only if, the worker has achieved a protective seal. This is accomplished by the worker being medically qualified to wear the specific respirator, fit tested to ensure a protective seal was achieved, and he/she has had the appropriate training to maintain the respirator in good condition in accordance with the American National Standards Institute (ANSI) and or OSHA 29CFR 1910.134).

NF = Not Feasible; **ND** = No Data

Table 2c . Diazinon Engineering Controls PHED Unit Exposures [a]											
Exposure Scenario Equipment / Usage	**Dermal Unit Exposure (mg/lb ai) (dermal+hands)**	**Derm. Data Confid.**	**Derm. Grades**	**Derm. Repli.**	**Hand Grade**	**Hand Repli.**	**Clothing Scenario [b]**	**Inhalatn. Unit Exposure (ug/lb ai)**	**Inhalatn. Data Confid.**	**Inhalatn. Grades**	**Inhalatn. Repli.**
Mixer/Loader											
Scenario # 1 Mixing/loading liquids											
a) Aerial / Chemigation b) Groundboom c) Airblast d) Rights-of-Way Sprayer e) High-pressure Handwand (Livestk Areas)	**0.0086**	**High**	**AB**	**16- 22**	**AB**	**31**	**LSS, LP, CRG**	**0.083**	**High**	**AB**	**27**
Scenario 2 Mixing/loading wettable powders											
a) Aerial / Chemigation b) Groundboom c) Airblast d) Rights-of-Way Sprayer e) High-pressure Handwand (Livestk Areas)	**0.021**	**Low**	**AB**	**6- 15**	**AB**	**5**	**LSS, LP, NG**	**0.24**	**Low**	**All**	**15**
Scenario # 3 Loading granules											
Tractor-drawn broadcast spreaders	**0.00017**	**Low**	**ABC**	**33- 78**	**All**	**10**	**LSS, LP, NG**	**0.034**	**High**	**AB**	**58**
Applicator											
Scenario # 4 Applying sprays / liquids											
a) Airblast	**0.019**	**High**	**AB**	**20-30**	**AB**	**20**	**LSS, LP, CRG**	**0.45**	**Low**	**ABC**	**9**
b) Groundboom	**0.005**	**Medium**	**ABC**	**20-31**	**ABC**	**16**	**LSS,LP,NG**	**0.043**	**High**	**AB**	**16**
c) Paintbrush	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**
d) Airless Sprayer	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**
e) High-pressure Handwand (Livestk Areas)	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**
f) Handgun (lawn) Sprayer	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**
g) Rights-of-Way Sprayer	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**
h) Fixed-wing Aircraft	**0.005**	**Medm**	**ABC**	**24-48**	**AB**	**34**	**LSS, LP, NG**	**0.068**	**Medm**	**ABC**	**23**
Scenario # 5 Applying granules											
Tractor-drawn broadcast spreaders	**0.0021**	**High**	**AB**	**27-30**	**AB**	**24**	**LSS,LP,NG**	**0.22**	**High**	**AB**	**37**

Table 2c . Diazinon Engineering Controls PHED Unit Exposures [a]											
Exposure Scenario Equipment / Usage	**Dermal Unit Exposure (mg/lb ai) (dermal+hands)**	**Derm. Data Confid.**	**Derm. Grades**	**Derm. Repli.**	**Hand Grade**	**Hand Repli.**	**Clothing Scenario [b]**	**Inhalatn. Unit Exposure (ug/lb ai)**	**Inhalatn. Data Confid.**	**Inhalatn. Grades**	**Inhalatn. Repli.**
Scenario # 6 Flagging (In support of aerial application)											
Sprays	**0.00022**	**High**	**AB**	**18-28**	**AB**	**30**	**LSS,LP,NG**	**0.007**	**High**	**AB**	**28**
Mixer/Loader/Applicator											
Scenario # 7 Mixing/loading/applying liquids											
a) Low Pressure Handwand	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**
b) Backpack sprayer	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**
c) High pressure handwand (greenhouse)	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**
Scenario # 8 Mixing/loading/applying wettable powders											
Low pressure handwand	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**
Scenario # 9 Loading/applying granules											
a) Belly Grinder	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**
b) Push-type spreader	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**

[a] The Pesticide Handler Exposure Database (PHED) Version 1.1

[b] Engineering Controls = single layer clothing and no gloves - LSS, LP, NG (except where noted chemical resistant gloves -- because the no glove scenario is not available) and closed mixing systems and enclosed cab tractors. Engineering Control inhalation unit exposures represents no respirator usage.

NF = Not Feasible; **ND** = No Data

(c). Occupational Postapplication Exposure

EPA has determined that there are potential short-term and intermediate-term post-application dermal exposures following typical use patterns associated with diazinon in occupational (non-residential) settings. Neither long-term dermal exposures nor inhalation exposures to diazinon are anticipated for post-application workers. The reentry interval (REI) is the time required between the last application of diazinon and reentry into the treated field to begin harvesting activities. REIs are determined from an exposure assessment at the point in time when MOEs are equal to or greater than 100.

The REI on current diazinon labels (e.g., EPA Reg. No. 100-460) is 24 hours for fruit and nut crops, vegetable crops, and field crops, and 12 hours for ornamentals.

Dislodgeable foliar residue data are used to estimate dermal postapplication exposures. For diazinon sufficient dislodgeable foliar residue (DFR) data are available for two crops: oranges (as reported in MRID No. 404666-01) and cabbages (as reported in MRID No. 402029-02). DFR data are insufficient for all other crops that are treated with diazinon. Orange tree data were used to estimate DFR values for other tree crops and grapes. The limit of detection (LOD) for the study was <0.004 $\mu g/cm^2$. The application rate used in the orange study was 1 lb ai/acre, and the data were extrapolated (linearly) to the maximum labeled rate for tree crops of 3 lb ai/acre. These DFR data were then adjusted (divided by 3) for grapes assuming a maximum application rate of 1 lb ai/acre. Triplicate orange leaf punch samples were collected at 0, 1, 2, 5, 7, and 14 days after treatment (DAT). The predicted DFR values indicated a dissipation rate of 24 percent diazinon per day for oranges. The limit of detection (LOD) for the cabbage study was <0.002 $\mu g/cm^2$. DFR values from the cabbage study were used to estimate exposure for low-growing crops (i.e., lettuce, broccoli). These crops are considered to have low potential exposure.

(d). Occupational Risk Characterization: Handler/Mixer/Loader/Applicator

(i). Individual Exposure Scenarios

HED estimated risks for the 27 occupational handler exposure scenarios previously listed. The risk estimates calculated as MOEs are presented in a series of tables. Risk estimates for short-term, dermal exposures are provided in Tables 3(a) and 3(b). Risk estimates for intermediate-term and long-term, dermal exposures are provided in Tables 4(a) and 4(b). Risk estimates for inhalation exposures (any time period) are provided in Tables 5(a) and 5(b). Dermal and inhalation risk estimates were calculated based on the dermal and inhalation unit exposures given in Tables 2 (a-c) for each of the 27 exposure scenarios, the general assumptions about acres treated and body weights given above in Table 1, and on the premise of increasingly protective measures, i.e., starting at baseline protective clothing and moving to additional personal protective equipment (PPE), and finally to the use of engineering controls.

A range of application rates were used in the exposure assessments to provide a range of exposure and risk estimates across various occupational uses of diazinon. Specifically, the

exposure and risk estimates presented in Tables 3(a), 4(a), and 5(a) under the headings "minimum", "typical", and "maximum" are based on an application rate of 0.01, 0.02, and 0.08 lbs ai/gallon, respectively. These application rates are believed to represent the low end of the range of application rates for diazinon products with residential uses, and correspond to labeled rates for wettable powder formulations used on beans, beets and broccoli, i.e., crops with a low exposure potential. Note that the use of the lower application rates does not apply to many of the occupational exposure scenarios. Occupational exposure scenarios for which the lower application rates are applicable have been included in Tables 3(a), 4(a), and 5(a). In Tables 3(b), 4(b), and 5(b) the exposure and risk estimates presented under the headings "minimum", "typical", and "maximum" are based on an application rate of 0.20, 2.0, and 5.0 lbs ai/gallon **or** 0.25, 1.0, and 4.0 lbs ai/Acre, respectively. These application rates are believed to represent the higher range of application rates for diazinon products with agricultural and residential uses, and correspond to labeled rates for formulations used in/on greenhouses, livestock areas, rights-of-way, and non-occupational indoor/outdoor environments with a high exposure potential.

Discussion of Tables 3(a) and 3(b)

Risk Estimates Based on Short-Term Dermal Exposure:

- The estimates of risk based on short-term dermal exposure in the tables below indicate that the MOEs are equal to, or greater than 100 using baseline protection for 1 scenario: Scenario (3), Loading granules, in support of tractor-drawn broadcast spreaders at a 0.25 lbs ai/Acre application rate (at minimum application rate).

- With Additional PPE, MOEs are equal to, or greater than 100 for short-term risk estimates based on dermal exposures for the following 7 scenarios:

  (1c) Mixing/loading liquids for airblast application at a 0.25 lbs ai/Acre application rate;

  (1d) Mixing/loading liquids for right-of-way application at a 0.25 lbs ai/Acre application rate;

  (1e) Mixing/loading liquids with a high-pressure hand-wand in livestock areas at a 0.01 lbs ai/gallon application rate;

  (3) Loading granules, tractor-drawn broadcast spreaders at a 0.25 lbs ai/Acre application rate;

  (4f) Applying sprays, with hand-gun (lawn) sprayers at a 0.25 lbs ai/Acre application rate;

  (5) Applying granules with tractor-drawn broadcast spreaders at a 0.25

lbs ai/Acre application rate;

(7a) Mixing/Loading/Applying liquids with low pressure hand-wands at a 0.25 lbs ai/Acre application rate;

· Using Engineering Controls, MOEs for the following 8 scenarios are equal to, or greater than 100:

(1b) Mixing/loading liquids for groundboom application at a 0.25 lbs ai/Acre application rate;

(1c) Mixing/loading liquids for airblast application at a 0.25 lbs ai/Acre application rate;

(1d) Mixing/loading liquids for right-of-way application at a 0.25 lbs ai/Acre application rate;

(1e) Mixing/loading liquids for high-pressure handwand application in livestock areas at 0.01 and 0.02 lbs ai/gallon application rates;

(3) Loading granules for tractor-drawn broadcast application at 0.25, 1.0, and 4.0 lbs ai/Acre application rates;

(4b) Applying sprays and liquids for groundboom application at a 0.25 lbs ai/Acre application rate;

(5) Applying granules with a tractor-drawn broadcast spreader at a 0.25 lbs ai/Acre application rate;

(6) Flagging sprays at 0.25 and 1.0 lbs ai/Acre application rates.

For the following scenarios, MOEs are less than 100, after applying engineering controls (if feasible) and considering the minimum application rate:

(1a) Mixing/loading liquid for aerial/chemigation applications;
(2) Mixing/loading wettable powders- all scenarios;
(4a) Applying sprays/liquid- all scenarios, except for groundboom applications;
(7) M/L/A liquids with (b) backpacks and (c) low pressure hand-wands;
(8) M/L/A wettable powders with low pressure hand-wands; and
(9) L/A granules with (a) belly griders and (b) push-type spreaders.

Table 3a. Occupational Handler Dermal Short-Term MOEs for 0.01 - 0.08 lbs ai/gallon. *(Based on NOAEL = 0.25 mg/kg/day.)*									
Exposure Scenario Equipment /Usage	Baseline			Maximum PPE			Engineering Controls		
	Min.	Typical	Max.	Min.	Typical	Max.	Min.	Typical	Max.
Scenario #1 - Mixing/loading liquids									
a) Aerial / Chemigation	*Lower application rates are not applicable to these exposure scenarios.*								
b) Groundboom									
c) Airblast									
d) Rights-of-Way Sprayer									
e) High-pressure Handwand (Livestock Areas)	0.60	0.30	0.075	100	52	13	200	100	25
Scenario #2 - Mixing/loading wettable powders									
a) Aerial / Chemigation	*Lower application rates are not applicable to these exposure scenarios.*								
b) Groundboom									
c) Airblast									
d) Rights-of-Way Sprayer									
e) High-pressure Handwand (Livestock Areas)	0.47	0.24	0.059	14	6.7	1.7	83	42	10
Scenario #3 - Loading granules									
Tractor-drawn broadcast spreaders	*Lower application rates are not applicable to these exposure scenarios.*								
Scenarios #4 - Applying sprays / liquids									
a) Airblast	*Lower application rates are not applicable to these exposure scenarios.*								
b) Groundboom									
c) Paintbrush	1.9	0.97	0.24	16	8.0	2.0	NF	NF	NF
d) Airless Sprayer	1.2	0.58	0.14	3.1	1.6	0.39	NF	NF	NF
e) High-pressure Handwand (Livestock Areas)	0.97	0.49	0.12	4.9	2.4	0.61	NF	NF	NF
f) Handgun (lawn) Sprayer	Lower application rates are not applicable to these exposure scenarios.								
g) Rights-of-Way Sprayer									
h) Fixed-wing Aircraft									
Scenario #5 Applying granules									
Tractor-drawn broadcast spreaders	Lower application rates are not applicable to these exposure scenarios.								

Table 3a. Occupational Handler Dermal Short-Term MOEs for 0.01 - 0.08 lbs ai/gallon. *(Based on NOAEL = 0.25 mg/kg/day.)*									
Exposure Scenario Equipment /Usage	Baseline			Maximum PPE			Engineering Controls		
Scenario #6 - Flagging									
Sprays	Lower application rates are not applicable to these exposure scenarios.								
Scenario #7 Mixing/loading/applying liquids									
a) Low Pressure Handwand	Lower application rates are not applicable to these exposure scenarios.								
b) Backpack sprayer									
c) High pressure handwand (greenhouse)	**0.50**	**0.25**	**0.062**	**1.1**	**0.55**	**0.14**	**NF**	**NF**	**NF**
Scenario #8 Mixing/loading/applying (wettable powders)									
Low pressure handwand	Lower application rates are not applicable to these exposure scenarios.								
Scenario #9 Loading/applying granules									
a) Belly Grinder	Lower application rates are not applicable to these exposure scenarios.								
b) Push-type spreader **(No head &neck data available)**									

[a] Baseline dermal unit exposure represents long pants, long sleeved shirt, no gloves, open mixing/loading, and open cab tractor; except for backpack sprayers. Chemical resistant gloves are included for the backpack assessment because the no glove scenario is not available. Baseline data are not available for aerial application.

[b] Additional Personal Protective Equipment (PPE) to reduce dermal exposures = workers wearing coveralls over single layer clothing and chemical resistant gloves [Double Layer Clothing with Chemical Resistant Gloves (DLC, CRG)]. PPE data are not available for aerial application.

[c] Engineering Controls = single layer clothing and no gloves (except where noted chemical resistant gloves -- because the no glove scenario is not available) and closed mixing systems and enclosed cab tractors.

[d] Application rates are a range of representative and maximum rates values found in the diazinon labels. The following labels were used to determine the rates:
(1) Wettable powders - EPA Reg. No. 100-460 (Diazinon 50 W). Min. rate represents beans, beets, broccoli, etc. Max. rate represents beans, beets, broccoli, etc.
(2) Liquid formulations - EPA Reg. Nos. 100-784 (AG600 WBC) and 100-461 (AG500 emulsifiable solution). Min. rate represents apricots, beets, etc. Max. rate represents beans, etc. Rights-of-way rate is located on the EPA Reg. No. 100-461.
(3) Granular - EPA Reg. No. 100-469 (Diazinon 14G) and Diazinon Granular Lawn Insect Control (2 percent).
Daily acres treated values are from the EPA HED estimates of acreage that could be treated in a single day for each exposure scenario of concern. The granular lawn area is restricted to a maximum of 15,000 ft2 (EPA Reg. No. 100-468).

Application Rates

	Minimum	Typical	Maximum
Lb. ai./Gallon	0.01	0.02	0.08

Dermal Absorption Correction factor =100%; **NF** = Not Feasible; **ND** = No Data;

Table 3b. Occupational Handler Dermal Short-term MOEs for 0.2 - 5 lbs ai/gallon. or Acre *(Based on NOAEL = 0.25 mg/kg/day.)*									
Exposure Scenario Equipment /Usage	Baseline			Maximum PPE			Engineering Controls		
	Min.	Typical	Max.	Min.	Typical	Max.	Min.	Typical	Max.
Scenario #1 - Mixing/loading liquids									
a) Aerial / Chemigation	0.069	0.017	0.0043	12	3	0.74	23	5.8	1.4
b) Groundboom	0.30	0.075	0.019	52	13	3.2	100	25	6.4
c) Airblast	0.60	0.15	0.038	100	26	6.4	200	51	13
d) Rights-of-Way Sprayer	0.60	0.15	0.038	100	26	6.4	200	51	13
e) High-pressure Handwand (Livestock Areas)	0.03	0.0030	0.0012	5.2	0.51	0.21	10	1	0.47
Scenario #2 - Mixing/loading wettable powders									
a) Aerial / Chemigation	0.054	0.014	0.0034	1.54	0.38	0.092	9.5	2.4	0.60
b) Groundboom	0.24	0.059	0.015	6.73	1.68	0.42	42	10	2.6
c) Airblast	0.47	0.12	0.03	14	3.4	0.84	83	21	5.2
d) Rights-of-Way Sprayer	0.47	0.12	0.03	14	3.4	0.84	83	21	5.2
e) High-pressure Handwand (Livestock Areas)	0.024	0.0024	0.00095	0.67	0.067	0.027	4.2	0.42	0.17
Scenario #3 - Loading granules									
Tractor-drawn broadcast spreaders	100	26	6.5	260	64	16	5200	1300	320
Scenarios #4 - Applying sprays / liquids									
a) Airblast	4.9	1.2	0.30	8	2.0	0.50	92	23	5.8
b) Groundboom	62	16	3.9	62	16	3.9	180	44	11
c) Paintbrush	0.097	0.0097	0.0039	0.80	0.08	0.032	NF	NF	NF
d) Airless Sprayer	0.058	0.0058	0.0023	0.16	0.016	0.0062	NF	NF	NF
e) High-pressure Handwand (Livestock Areas)	0.049	0.0049	0.0019	0.24	0.024	0.0097	NF	NF	NF
f) Handgun (lawn) Sprayer	30	7.6	1.9	120	31	7.8	NF	NF	NF
g) Rights-of-Way Sprayer	1.4	0.34	0.084	6	1.5	0.38	NF	NF	NF
h) Fixed-wing Aircraft	ND	ND	ND	ND	ND	ND	40	10	2.5

Table 3b. Occupational Handler Dermal Short-term MOEs for 0.2 - 5 lbs ai/gallon. or Acre *(Based on NOAEL = 0.25 mg/kg/day.)*									
Exposure Scenario Equipment /Usage	Baseline			Maximum PPE			Engineering Controls		
	Min.	Typical	Max.	Min.	Typical	Max.	Min.	Typical	Max.
Scenario #5 Applying granules									
Tractor-drawn broadcast spreaders	88	22	5.5	210	52	13	420	100	26
Scenario #6 - Flagging									
Sprays	18	4.6	1.1	20	5	1.2	910	230	57
Scenario #7 Mixing/loading/applying liquids									
a) Low Pressure Handwand	0.69	0.18	0.044	190	47	12	NF	NF	NF
b) Backpack sprayer	28	6.9	1.8	44	11	2.7	NF	NF	NF
c) High pressure handwand (greenhouse)	0.025	0.0025	0.001	0.057	0.0057	0.0022	NF	NF	NF
Scenario #8 Mixing/loading/applying (wettable powders)									
Low pressure handwand	8.1	2.1	0.51	11	2.8	0.71	NF	NF	NF
Scenario #9 Loading/applying granules									
a) Belly Grinder	6.9	1.8	0.44	12	3.1	0.78	NF	NF	NF
b) Push-type spreader (no head & neck data available)	8.1	2.1	0.50	32	8.1	2.1	NF	NF	NF

[a] Baseline dermal unit exposure represents long pants, long sleeved shirt, no gloves, open mixing/loading, and open cab tractor; except for backpack sprayers. Chemical resistant gloves are included for the backpack assessment because the no glove scenario is not available. Baseline data are not available for aerial application.

[b] Additional Personal Protective Equipment (PPE) to reduce dermal exposures = workers wearing coveralls over single layer clothing and chemical resistant gloves [Double Layer Clothing with Chemical Resistant Gloves (DLC, CRG)]. PPE data are not available for aerial application.

[c] Engineering Controls = single layer clothing and no gloves (except where noted chemical resistant gloves -- because the no glove scenario is not available) and closed mixing systems and enclosed cab tractors.

[d] Application rates are a range of representative and maximum rates values found in the diazinon labels. The following labels were used to determine the rates:

(1) Wettable powders - EPA Reg. No. 100-460 (Diazinon 50 W). Min. rate represents beans, beets, broccoli, etc. Max. rate represents beans, beets, broccoli, etc.
(2) Liquid formulations - EPA Reg. Nos. 100-784 (AG600 WBC) and 100-461 (AG500 emulsifiable solution). Min. rate represents apricots, beets, etc. Max. rate represents beans, etc. Rights-of-way rate is located on the EPA Reg. No. 100-461.
(3) Granular - EPA Reg. No. 100-469 (Diazinon 14G) and Diazinon Granular Lawn Insect Control (2 percent).

Daily acres treated values are from the EPA HED estimates of acreage that could be treated in a single day for each exposure scenario of concern. The granular lawn area is restricted to a maximum of 15,000 ft2 (EPA Reg. No. 100-468). Dermal Absorption Correction factor =100% **NA** = not applicable; **NF** = Not Feasible; **ND** = No Data

Application Rates

	Minimum	Typical	Maximum
Lb. a. i./Acre	0.25	1	4
Lb. a. i./Gallon	0.20	2	5

The results of the intermediate- and long-term dermal handler exposure and risk assessments, (Tables 4(a) and 4(b)) show that except for one scenario [(3) loading granules in support of tractor-drawn spreaders], all exposure scenarios have MOEs less than 100, and

exceed HED's level of concern, even with engineering controls applied where appropriate and considering minimum application rates.

Discussion of Tables 4(a) and 4(b)

Risks Based on Intermediate- and Long-Term Dermal Exposures:

NO intermediate- or long-term, dermal exposure scenarios using baseline protection have MOEs equal to or greater than 100.

With Additional PPE, MOEs are equal to, or greater than 100 for NO intermediate- or long-term, dermal exposure scenarios.

Using Engineering Controls, MOEs are equal to, or greater than 100 for one intermediate- or long-term, dermal exposure scenarios:
(3) Loading granules in support of tractor-drawn broadcast spreaders at 0.25 and 1.0 lbs ai/Acre application rates.

Table 4a. Occupational Handler Dermal Intermediate-term and Long-term MOEs for 0.01 - 0.08 lbs ai/gallon.
**** (Based on NOAEL = 0.02 mg/kg/day.)***

Exposure Scenario Equipment /Usage	Baseline [ad]			Maximum PPE [bd]			Engineering Controls [cd]		
	Min.	Typical	Max.	Min.	Typical	Max.	Min.	Typical	Max.
Scenario #1 - Mixing/loading liquids									
a) Aerial / Chemigation	Lower application rates are not applicable to these exposure scenarios.								
b) Groundboom									
c) Airblast									
d) Rights-of-Way Sprayer									
e) High-pressure Handwand (Livestock Areas)	0.048	0.024	6.03E-03	8.2	4.1	1.0	16	8.1	2.0
Scenario #2 - Mixing/loading wettable powders									
a) Aerial / Chemigation	Lower application rates are not applicable to these exposure scenarios.								
b) Groundboom									
c) Airblast									
d) Rights-of-Way Sprayer									
e) High-pressure Handwand (Livestock Areas)	0.038	0.019	4.73E-03	1.1	0.54	0.14	6.7	3.3	0.83
Scenario #3 - Loading granules									
Tractor-drawn broadcast spreaders	Lower application rates are not applicable to these exposure scenarios.								
Scenarios #4 - Applying sprays / liquids									

Table 4a. Occupational Handler Dermal Intermediate-term and Long-term MOEs for 0.01 - 0.08 lbs ai/gallon.
(Based on NOAEL = 0.02 mg/kg/day.)

Exposure Scenario Equipment /Usage	Baseline [ad]			Maximum PPE [bd]			Engineering Controls [cd]		
	Min.	Typical	Max.	Min.	Typical	Max.	Min.	Typical	Max.
a) Airblast	Lower application rates are not applicable to these exposure scenarios.								
b) Groundboom									
c) Paintbrush	0.16	0.078	0.019	1.3	0.64	0.16	NF	NF	NF
d) Airless Sprayer	0.092	9.21E-04	0.012	0.25	0.12	0.031	NF	NF	NF
e) High-pressure Handwand (Livestock Areas)	0.078	0.039	9.72E-03	0.39	0.19	0.049	NF	NF	NF
f) Handgun (lawn) Sprayer	Lower application rates are not applicable to these exposure scenarios.								
g) Rights-of-Way Sprayer									
h) Fixed-wing Aircraft									
Scenarios #5 Applying granules									
Tractor-drawn broadcast spreaders	Lower application rates are not applicable to these exposure scenarios.								
Scenario #6 - Flagging									
Sprays	Lower application rates are not applicable to these exposure scenarios.								
Scenarios #7 Mixing/loading/applying liquids									
a) Low Pressure Handwand	Lower application rates are not applicable to these exposure scenarios.								
b) Backpack sprayer									
c) High pressure handwand (greenhouse)	0.040	0.020	5.00E-03	0.088	0.044	0.011	NF	NF	NF
Scenarios #8 Mixing/loading/applying (wettable powders)									
Low pressure handwand	Lower application rates are not applicable to these exposure scenarios.								
Scenarios #9 Loading/applying granules									
a) Belly Grinder	Lower application rates are not applicable to these exposure scenarios.								
b) Push-type spreader									

* These scenarios (1d, 1e, 2d, 2e, 4c, 4e, 4f, 4g, 7 and 8) have potential long-term exposure patterns.

[a] Baseline dermal unit exposure represents long pants, long sleeved shirt, no gloves, open mixing/loading, and open cab tractor; except for backpack sprayers. Chemical resistant gloves are included for the backpack assessment because the no glove scenario is not available. Baseline data are not available for aerial application.

[b] Additional Personal Protective Equipment (PPE) to reduce dermal exposures = workers wearing coveralls over single layer clothing and chemical resistant gloves [Double Layer Clothing with Chemical Resistant Gloves (DLC, CRG)]. PPE data are not available for aerial application.

[c] Engineering Controls = single layer clothing and no gloves (except where noted chemical resistant gloves -- because the no glove scenario is not available) and closed mixing systems and enclosed cab tractors.

[d] Application rates are a range of representative and maximum rates values found in the diazinon labels. The following labels were used to determine the rates:
(1) Wettable powders - EPA Reg. No. 100-460 (Diazinon 50 W). Min. rate represents beans, beets, broccoli, etc. Max. rate represents beans, beets, broccoli, etc.
(2) Liquid formulations - EPA Reg. Nos. 100-784 (AG600 WBC) and 100-461 (AG500 emulsifiable solution). Min. rate represents apricots, beets, etc. Max. rate represents beans, etc. Rights-of-way rate is located on the EPA Reg. No. 100-461.
(3) Granular - EPA Reg. No. 100-469 (Diazinon 14G) and Diazinon Granular Lawn Insect Control (2 percent).

Daily acres treated values are from the EPA HED estimates of acreage that could be treated in a single day for each exposure scenario of concern. The granular lawn area is restricted to a maximum of 15,000 ft2 (EPA Reg. No. 100-468).

Dermal Absorption Correction factor =100%; **NF** = Not Feasible; **ND** = No Data.

Application Rates

	Minimum	Typical	Maximum
Lb. a. i./Gallon	0.01	0.02	0.08

Table 4b. Occupational Handler Dermal Intermediate-term and Long-term MOEs for 0.2 - 5 lbs ai/gal. or Acre. ** (Based on NOAEL = 0.02 mg/kg/day.)*									
Exposure Scenario Equipment /Usage	Baseline [ad]			Maximum PPE [bd]			Engineering Controls [cd]		
	Min.	Typical	Max.	Min.	Typical	Max.	Min.	Typical	Max.
Scenario #1 - Mixing/loading liquids									
a) Aerial / Chemigation	5.52E-03	1.38E-03	3.45E-04	9.41E-01	2.35E-01	5.88E-02	1.9	4.65E-01	1.16E-01
b) Groundboom	2.41E-02	6.03E-03	1.51E-03	4.1	1.0	2.57E-01	8.1	2.0	5.09E-01
c) Airblast	4.83E-02	1.21E-02	3.02E-03	8.2	2.1	5.15E-01	16	4.1	1.0
d) Rights-of-Way Sprayer	4.83E-02	1.21E-02	3.02E-03	8.2	2.1	5.15E-01	16	4.1	1.0
e) High-pressure Handwand (Livestock Areas)	2.41E-03	2.41E-04	9.66E-05	4.12E-01	4.12E-02	1.65E-02	8.14E-01	8.14E-02	3.26E-02
Scenario #2 - Mixing/loading wettable powders									
a) Aerial / Chemigation	4.32E-03	1.08E-03	2.70E-04	1.23E-01	3.08E-02	7.69E-03	7.62E-01	1.90E-01	4.76E-02
b) Groundboom	1.89E-02	4.73E-03	1.18E-03	5.38E-01	1.35E-01	3.37E-02	3.3	8.33E-01	2.08E-01
c) Airblast	3.78E-02	9.46E-03	2.36E-03	1.1	2.69E-01	6.73E-02	6.7	1.7	4.17E-01
d) Rights-of-Way Sprayer	3.78E-02	9.46E-03	2.36E-03	1.1	2.69E-01	6.73E-02	6.7	1.7	4.17E-01
e) High-pressure Handwand (Livestock Areas)	1.89E-03	1.89E-04	7.57E-05	5.38E-02	5.38E-03	2.15E-03	3.33E-01	3.33E-02	1.33E-02
Scenario #3 - Loading granules									
Tractor-drawn broadcast spreaders	8.3	2.1	5.21E-01	2.06E+01	5.2	1.3	410	100	26
Scenarios #4 - Applying sprays / liquids									
a) Airblast	3.89E-01	9.72E-02	2.43E-02	6.36E-01	1.59E-01	3.98E-02	7.4	1.8	4.61E-01
b) Groundboom	5.0	1.2	3.13E-01	5.0	1.2	3.13E-01	14	3.5	8.75E-01
c) Paintbrush	7.78E-03	7.78E-04	3.11E-04	6.36E-02	6.36E-03	2.55E-03	NF	NF	NF
d) Airless Sprayer	4.61E-03	9.21E-04	1.84E-04	1.25E-02	1.25E-03	5.00E-04	NF	NF	NF
e) High-pressure Handwand (Livestock Areas)	3.89E-03	3.89E-04	1.56E-04	1.94E-02	1.94E-03	7.78E-04	NF	NF	NF
f) Handgun (lawn) Sprayer	2.4	0.61	0.15	10	2.5	0.62	NF	NF	NF
g) Rights-of-Way Sprayer	1.08E-01	2.69E-02	6.73E-03	4.83E-01	1.21E-01	3.02E-02	NF	NF	NF
h) Fixed-wing Aircraft	ND	ND	ND	ND	ND	ND	3.2	8.00E-01	2.00E-01
Scenarios #5 Applying granules									
Tractor-drawn broadcast spreaders	7.1	1.8	4.42E-01	17	4.2	1.0	33	8.3	2.1
Scenario #6 - Flagging									
Sprays	1.4	3.64E-01	9.09E-02	1.6	4.00E-01	1.00E-01	73	18	4.6

Table 4b. Occupational Handler Dermal Intermediate-term and Long-term MOEs for 0.2 - 5 lbs ai/gal. or Acre. ** (Based on NOAEL = 0.02 mg/kg/day.)*									
Exposure Scenario Equipment /Usage	Baseline [ad]			Maximum PPE [bd]			Engineering Controls [cd]		
	Min.	Typical	Max.	Min.	Typical	Max.	Min.	Typical	Max.
Scenarios #7 Mixing/loading/applying liquids									
a) Low Pressure Handwand	0.056	0.014	0.0035	15	3.8	0.95	NF	NF	NF
b) Backpack sprayer	2.2	0.56	0.14	3.5	0.87	0.22	NF	NF	NF
c) High pressure handwand (greenhouse)	2.00E-03	2.00E-04	8.00E-05	4.38E-03	4.38E-04	1.75E-04	NF	NF	NF
Scenarios #8 Mixing/loading/applying (wettable powders)									
Low pressure handwand	0.64	0.17	0.041	0.91	0.22	0.057	NF	NF	NF
Scenarios #9 Loading/applying granules									
a) Belly Grinder	0.56	0.14	0.035	1	0.25	0.062	NF	NF	NF
b) Push-type spreader (no head & neck data available)	0.64	0.17	0.04	2.6	0.64	0.17	NF	NF	NF

* These scenarios (1d, 1e, 2d, 2e, 4c, 4e, 4f, 4g, 7 and 8) have potential long-term exposure patterns.

[a] Baseline dermal unit exposure represents long pants, long sleeved shirt, no gloves, open mixing/loading, and open cab tractor; except for backpack sprayers. Chemical resistant gloves are included for the backpack assessment because the no glove scenario is not available. Baseline data are not available for aerial application.

[b] Additional Personal Protective Equipment (PPE) to reduce dermal exposures = workers wearing coveralls over single layer clothing and chemical resistant gloves [Double Layer Clothing with Chemical Resistant Gloves (DLC, CRG)]. PPE data are not available for aerial application.

[c] Engineering Controls = single layer clothing and no gloves (except where noted chemical resistant gloves -- because the no glove scenario is not available) and closed mixing systems and enclosed cab tractors.

[d] Application rates are a range of representative and maximum rates values found in the diazinon labels. The following labels were used to determine the rates:
(1) Wettable powders - EPA Reg. No. 100-460 (Diazinon 50 W). Min. rate represents beans, beets, broccoli, etc. Max. rate represents beans, beets, broccoli, etc.
(2) Liquid formulations - EPA Reg. Nos. 100-784 (AG600 WBC) and 100-461 (AG500 emulsifiable solution). Min. rate represents apricots, beets, etc. Max. rate represents beans, etc. Rights-of-way rate is located on the EPA Reg. No. 100-461.
(3) Granular - EPA Reg. No. 100-469 (Diazinon 14G) and Diazinon Granular Lawn Insect Control (2 percent).
Daily acres treated values are from the EPA HED estimates of acreage that could be treated in a single day for each exposure scenario of concern. The granular lawn area is restricted to a maximum of 15,000 ft2 (EPA Reg. No. 100-468).

Dermal Absorption Correction factor =100% . **NA** = not applicable; **NF** = Not Feasible; **ND** = No Data

	Application Rates		
	Minimum	Typical	Maximum
lb a. i./Acre	0.25	1	4
lb a. i./Gallon	0.20	2	5

The estimates of risk based on inhalation exposures in the tables below (Tables 5(a) and 5(b)) indicate that the MOEs are equal to, or greater than 300 at **baseline** for NO inhalation exposure scenarios, except for two scenarios 4 f- applying sprays with handguns to lawns, and 9b- loading and applying granules with push-type spreaders. All other baseline occupational inhalation handler exposure scenarios have risk estimates (MOEs) below 300; therefore they exceed HED's level of concern.

Discussion of Tables 5(a) and 5(b)

Risk Estimates Based on Inhalation Exposures:

- The estimates of risk based on inhalation exposures in the tables below indicate that the MOEs are equal to, or greater than 300 at baseline for NO inhalation exposure scenarios, except for scenarios 4 f- applying sprays with handguns to lawns (@ 0.25 lbs ai/A-MOE = 1700; and @ 1 lb ai/A-MOE = 430), and 9b- loading and applying granules with push-type spreaders (@ 0.25 lb ai/A-MOE =390).

- With Additional PPE (with a half mask respirator), MOEs are equal to, or greater than 300 for the following 16 scenarios:

  (1b) Mixing/loading liquids for groundboom applications, at a 0.25 lb ai/Acre application rate;

  (1c) Mixing/loading liquids for airblast applications, at a 0.25 lb ai/Acre application rate;

  (1d) Mixing/loading liquids for right-of-way applications, at a 0.25 lb ai/Acre application rate;

  (1e) Mixing/loading liquids for high-pressure handwands in livestock areas, at 0.01 & 0.02 lbs ai/gallon application rates;

  (3) Loading granules with tractor-drawn broadcast spreaders, at a 0.25 lb ai/Acre application rate;

  (4a) Applying liquids with airblast sprayers, at a 0.25 lb ai/Acre application rate;

  (4b) Applying liquids with groundboom sprayers, at 0.25 & 1 lb ai/Acre application rates;

  (4c) Applying liquids with paint brushes, at 0.01 & 0.02 lbs ai/gallon application rates;

(4f) Applying liquids with hand-gun lawn sprayers, at all (0.25 ,1, & 4 lb ai/Acre) application rates;

(4g) Applying liquids with rights-of-way sprayers, at a 0.25 lb ai/Acre application rate;

(5) Applying granules with tractor-drawn broadcast spreaders, at a 0.25 lbs ai/Acre application rate;

(6) Flagging sprays (in support of aerial application), at a 0.25 lb ai/Acre application rate.

(7a) Mixing/Loading/Applying sprays with low pressure hand-wands, at 0.25 & 1 lb. ai/Acre application rates;

(7b) Mixing/Loading/Applying sprays with backpack sprayers, at 0.25 & 1 lb. ai/Acre application rates;

(9a) Loading/Applying granules with belly-grinders, at a 0.25 lb. ai/Acre application rate;

(9b) Loading/Applying granules with push-type spreaders, at 0.25 & 1 lb. ai/Acre application rates;

· Using Engineering Controls [closed mixing system or enclosed cabs with air filtrating systems in accordance with the Worker Protection Standard (WPS)], MOEs for the following 14 scenarios are equal to, or greater than 300:

(1b) Closed Mixing/loading liquids for groundboom application at a 0.25 lb ai/Acre application rate;

(1c) Closed Mixing/loading liquids for airblast application at 0.25, & 1 lb ai/Acre application rates;

(1d) Closed Mixing/loading liquids for right-of-way application at 0.25, 1 lb ai/Acre application rates;

(1e) Closed Mixing/loading liquids for high-pressure handwand in livestock areas at 0.01, & 0.02 lbs ai/gallon application rates;

(2b) Closed Mixing/loading wettable powders for groundboom application at a 0.25 lb ai/Acre application rate;

(2c) Closed Mixing/loading wettable powders for airblast application at a 0.25 lb ai/Acre application rate;

(2d) Closed Mixing/loading wettable powders for right-of-way application at a 0.25 lb ai/Acre application rate;

(2e) Closed Mixing/loading wettable powders for high-pressure hand-wand application in livestock areas at 0.01, & 0.02 lbs ai/gallon application rates;

(3) Closed Loading granular, tractor-drawn broadcast spreaders at 0.25, & 1 lb ai/Acre application rates;

(4a) Applying sprays with enclosed cab airblast sprayers at a 0.25 lb ai/Acre application rate;

(4b) Applying sprays with enclosed cab groundboom sprayers at a 0.25 , & 1 lb ai/Acre application rates;

(4h) Applying sprays with fixed-winged enclosed cockpits at a 0.25 lb ai/Acre application rate;

(5) Applying granules with enclosed cab tractor-drawn broadcast spreaders at a 0.25 lbs ai/Acre application rate; and

(6) Flagging sprays with enclosed cab vehicles (in support of aerial application) at 0.25, & 1 lb ai/Acre application rates.

For the following scenarios, MOEs are less than 300, after applying engineering controls (if feasible) and considering the minimum application rate:

(1a) Mixing/loading liquid for aerial/chemigation applications;
(2a) Mixing/loading wettable powders for aerial/chemigation applications;
(4) Applying sprays/liquid with (d) airless sprayers and (e) high pressure hand-wands applications;
(7) M/L/A liquids with (c) low pressure hand-wands; and
(8) M/L/A wettable powders with low pressure hand-wands.

Table 5a. Occupational Handler Inhalation MOEs for 0.01 - 0.08 lbs ai/gallon. *(Based on LOAEL = 0.026 mg/kg/day.)*									
Exposure Scenario Equipment /Usage	Baseline [ad]			Maximum PPE [bd]			Engineering Controls [cd]		
	Min.	Typical	Max.	Min.	Typical	Max.	Min.	Typical	Max.
Scenario #1 - Mixing/loading liquids									
a) Aerial / Chemigation	Lower application rates are not applicable to these exposure scenarios.								
b) Groundboom									
c) Airblast									
d) Rights-of-Way Sprayer									
e) High-pressure Handwand (Livestock Areas)	150	76	19	760	380 [1] 760 [2]	95	2200	1100	270
Scenario #2 - Mixing/loading wettable powders									
a) Aerial / Chemigation	Lower application rates are not applicable to these exposure scenarios.								
b) Groundboom									
c) Airblast									
d) Rights-of-Way Sprayer									
e) High-pressure Handwand (Livestock Areas)	4.2	2.1	0.53	21	11	2.6	760	380	95
Scenario #3 - Loading granules									
Tractor-drawn broadcast spreaders	Lower application rates are not applicable to these exposure scenarios.								
Scenarios #4 - Applying sprays / liquids									
a) Airblast	Lower application rates are not applicable to these exposure scenarios.								
b) Groundboom									
c) Paintbrush	130	65	16	650	320 [1] 640 [2]	81	NF	NF	NF
d) Airless Sprayer	5.5	2.7	0.68	27	13	3.4	NF	NF	NF
e) High-pressure Handwand (Livestock Areas)	2.3	1.2	0.29	11	5.7	1.4	NF	NF	NF
f) Handgun (lawn) Sprayer	Lower application rates are not applicable to these exposure scenarios.								
g) Rights-of-Way Sprayer									
h) Fixed-wing Aircraft									
Scenario #5 Applying granules									
Tractor-drawn broadcast spreaders	ND	ND	ND	ND	ND	ND	16	4.0	1.0
	Lower application rates are not applicable to these exposure scenarios.								
Scenario #6 - Flagging									
Sprays	Lower application rates are not applicable to these exposure scenarios.								

Table 5a. Occupational Handler Inhalation MOEs for 0.01 - 0.08 lbs ai/gallon. *(Based on LOAEL = 0.026 mg/kg/day.)*									
Exposure Scenario Equipment /Usage	Baseline [ad]			Maximum PPE [bd]			Engineering Controls [cd]		
	Min.	Typical	Max.	Min.	Typical	Max.	Min.	Typical	Max.
Scenario # 7 Mixing/loading/applying liquids									
a) Low Pressure Handwand	Lower application rates are not applicable to these exposure scenarios.								
b) Backpack sprayer									
c) High pressure handwand (greenhouse)	1.5	0.76	0.19	7.6	3.8	0.95	NF	NF	NF
Scenario # 8 Mixing/loading/applying (wettable powders)									
Low pressure handwand	Lower application rates are not applicable to these exposure scenarios.								
Scenario # 9 Loading/applying granules									
a) Belly Grinder	Lower application rates are not applicable to these exposure scenarios.								
b) Push-type spreader									

[a] Baseline data are not available for aerial application. Baseline inhalation exposure represents no respirator.

[b] PPE inhalation exposure represents use of a respirator = dust/mist respirator applied to the baseline unit exposure (**Decreases the baseline unit exposure by 80%, if and only if, the worker has achieved a protective seal. This is accomplished by the worker being medically qualified to wear the specific respirator, fit tested to ensure a protective seal was achieved, and he/she has had the appropriate training to maintain the respirator in good condition in accordance with the American National Standards Institute (ANSI) and or OSHA 29CFR 1910.134**).

[c] Engineering Controls = single layer clothing and no gloves (except where noted chemical resistant gloves -- because the no glove scenario is not available) and closed mixing systems and enclosed cab tractors.

[d] Application rates are a range of representative and maximum rates values found in the diazinon labels. The following labels were used to determine the rates:
(1) Wettable powders - EPA Reg. No. 100-460 (Diazinon 50 W). Min. rate represents beans, beets, broccoli, etc. Max. rate represents beans, beets, broccoli, etc.
(2) Liquid formulations - EPA Reg. Nos. 100-784 (AG600 WBC) and 100-461 (AG500 emulsifiable solution). Min. rate represents apricots, beets, etc. Max. rate represents beans, etc. Rights-of-way rate is located on the EPA Reg. No. 100-461.
(3) Granular - EPA Reg. No. 100-469 (Diazinon 14G) and Diazinon Granular Lawn Insect Control (2 percent).
Daily acres treated values are from the EPA HED estimates of acreage that could be treated in a single day for each exposure scenario of concern. The granular lawn area is restricted to a maximum of 15,000 ft2 (EPA Reg. No. 100-468).
Daily inhalation Dose (mg/kg/day)= Dose{[(µg/lb ai) * (1mg/1000 µg) Conversion * Application Rate (lb ai/A or per gallon) * Acres or gallons treated]/70 kg BW}.
Margin Of Exposure (MOE) = Inhalation (for all time frequencies) LOAEL (0.026 mg/kg/day)/Daily Inhalation Dose. *The **Inhalation Target MOE = 300; which does not exceed HED's level of concern.***

Application Rates

	Minimum	Typical	Maximum
Lb. a. i./Gallon	0.01	0.02	0.08

NF = Not Feasible; **ND** = No Data.

Table 5b. Occupational Handler Inhalation MOEs for 0.2 - 5 lbs ai/gallon or Acre. *(Based on LOAEL = 0.026 mg/kg/day.)*									
Exposure Scenario Equipment /Usage	Baseline [ad]			Maximum PPE [bd]			Engineering Controls [cd]		
	Min.	Typical	Max.	Min.	Typical	Max.	Min.	Typical	Max.
Scenario #1 - Mixing/loading liquids									
a) Aerial / Chemigation	17	4.3	1.1	87	22	5.4	250	63	16
b) Groundboom	76	19	4.7	380	95	24	1100	270	69
c) Airblast	150	38	9.5	760	190 [1] 380 [2]	47	2200	550	140
d) Rights-of-Way Sprayer	150	38	9.5	760	190 [1] 380 [2]	47	2200	550	140
e) High-pressure Handwand (Livestock Areas)	7.6	7.6 E-01	3.0 E-01	38	3.8	1.5	110	11	4.4
Scenario #2 - Mixing/loading wettable powders									
a) Aerial / Chemigation	0.48	1.2 E-01	3.0 E-02	2.4	6.0 E-01	1.5 E-01	87	22	5.4
b) Groundboom	2.1	5.3 E-01	1.3 E-01	11	2.7	6.6 E-01	380	95	24
c) Airblast	4.2	1.1	2.7 E-01	21	5.3	1.3	760	190	47
d) Rights-of-Way Sprayer	4.2	1.1	2.7 E-01	21	5.3	1.3	760	190	47
e) High-pressure Handwand (Livestock Areas)	2.1 E-01	2.1 E-02	8.5 E-03	1.1	1.1 E-01	4.2 E-02	38	3.8	1.5
Scenario #3 - Loading granules									
Tractor-drawn broadcast spreaders	53	13	3.4	270 [1] 540 [2]	67	17	2700	670	170

Table 5b. Occupational Handler Inhalation MOEs for 0.2 - 5 lbs ai/gallon or Acre. *(Based on LOAEL = 0.026 mg/kg/day.)*									
Exposure Scenario Equipment /Usage	Baseline [ad]			Maximum PPE [bd]			Engineering Controls [cd]		
	Min.	Typical	Max.	Min.	Typical	Max.	Min.	Typical	Max.
Scenarios #4 - Applying sprays / liquids									
a) Airblast	40	10	2.5	200 [1] 400 [2]	51	13	400	100	25
b) Groundboom	120	31	7.7	600	150 [1] 300 [2]	38	2100	530	130
c) Paintbrush	6.5	6.5 E-01	2.6 E-01	32	3.2	1.3	NF	NF	NF
d) Airless Sprayer	2.7 E-01	2.7 E-02	1.1 E-02	1.3	1.3 E-01	5.3 E-02	NF	NF	NF
e) High-pressure Handwand (Livestock Areas)	1.1 E-01	1.1 E-02	4.6 E-03	5.7 E-01	5.7 E-02	2.3 E-02	NF	NF	NF
f) Handgun (lawn) Sprayer	1700	430	110	8700	2200	540	NF	NF	NF
g) Rights-of-Way Sprayer	47	12	2.9	230 [1] 460 [2]	58	15	NF	NF	NF
h) Fixed-wing Aircraft	ND	ND	ND	ND	ND	ND	310	77	19
Scenario #5 Applying granules									
Tractor-drawn broadcast spreaders	76	19	4.7	380 [1] 760 [2]	95 [1] 190 [2]	24 [1] 50 [2]	410	100	26
Scenario #6 - Flagging									
Sprays	59	15	3.7	300 [1] 600 [2]	74 [1] 150 [2]	19 [1] 40 [2]	3000	740	190
Scenario # 7 Mixing/loading/applying liquids									
a) Low Pressure handwand	240	61	15	1200	300 [1] 610 [2]	76 [1] 152 [2]	NF	NF	NF
b) Backpack sprayer	240	61	15	1200	300 [1] 610 [2]	76 [1] 152 [2]	NF	NF	NF
c) High pressure handwand (greenhouse)	7.6 E-02	7.6 E-03	3.0 E-03	3.8 E-01	3.8 E-02	1.5 E-02	NF	NF	NF
Scenario # 8 Mixing/loading/applying (wettable powders)									
Low pressure handwand	6.6	1.7	0.41	33 [1] 66 [2]	8.3 [1] 17 [2]	2.1 [1] 4.1 [2]	NF	NF	NF

Table 5b. Occupational Handler Inhalation MOEs for 0.2 - 5 lbs ai/gallon or Acre. *(Based on LOAEL = 0.026 mg/kg/day.)*									
Exposure Scenario Equipment /Usage	Baseline [ad]			Maximum PPE [bd]			Engineering Controls [cd]		
	Min.	Typical	Max.	Min.	Typical	Max.	Min.	Typical	Max.
Scenario # 9 Loading/applying granules									
a) Belly Grinder	120	29	7.3	587	150 [1] 290 [2]	37 [1] 73 [2]	NF	NF	NF
b) Push-type spreader (No head & neck data available)	390	98	24	5900	490	120 [1] 240 [2]	NF	NF	NF

[a] Baseline data are not available for aerial application. Baseline inhalation exposure represents no respirator.

[b] PPE inhalation exposure represents use of a respirator = dust/mist respirator applied to the baseline unit exposure[(Decreases the baseline unit exposure by: [1] = 80% (1/4-Mask-Respirator) and [2] = 90% (1/2-Mask-Respirator), if and only if, the worker has achieved a protective seal. This is accomplished by the worker being medically qualified to wear the specific respirator, fit tested to ensure a protective seal was achieved, and he/she has had the appropriate training to maintain the respirator in good condition in accordance with the American National Standards Institute (ANSI) and or OSHA 29CFR 1910.134).

[c] Engineering Controls = single layer clothing and no gloves (except where noted chemical resistant gloves -- because the no glove scenario is not available) and closed mixing systems and enclosed cab tractors.

[d] Application rates are a range of representative and maximum rates values found in the diazinon labels. The following labels were used to determine the rates:
(1) Wettable powders - EPA Reg. No. 100-460 (Diazinon 50 W). Min. rate represents beans, beets, broccoli, etc. Max. rate represents beans, beets, broccoli, etc.
(2) Liquid formulations - EPA Reg. Nos. 100-784 (AG600 WBC) and 100-461 (AG500 emulsifiable solution). Min. rate represents apricots, beets, etc. Max. rate represents beans, etc. Rights-of-way rate is located on the EPA Reg. No. 100-461.
(3) Granular - EPA Reg. No. 100-469 (Diazinon 14G) and Diazinon Granular Lawn Insect Control (2 percent).
Daily acres treated values are from the EPA HED estimates of acreage that could be treated in a single day for each exposure scenario of concern. The granular lawn area is restricted to a maximum of 15,000 ft2 (EPA Reg. No. 100-468).
Daily Inhalation Dose (mg/kg/day)= [{Unit Exposure (µg/lb ai) * (1mg/1000 µg) Conversion * Application Rate (lb ai/A or per gallon) * Acres or gallons treated /day} / 70kg bw].

Margin Of Exposure (MOE) = Inhalation (for all time frequencies) LOAEL (0.026 mg/kg/day)/Daily Inhalation Dose. *The* ***Inhalation Target MOE = 300; which does not exceed HED's level of concern.***

Application Rates

	Minimum	Typical	Maximum
lb a. i./Acre	0.25	1	4
lb a. i./Gallon	0.20	2	5

NF = Not Feasible; **ND** = No Data; **NA** = Not applicable.

(ii). Risk Estimates from Adding Dermal and Inhalation Exposure.

Because the same toxicity endpoint (i.e., RBC cholinesterase inhibition) is applicable to both inhalation and dermal risk assessments, and because dermal and inhalation exposures may occur simultaneously, it is appropriate to add these exposures together to obtain a total risk estimate for occupational exposure. As seen above, at various label application use rates, several inhalation exposure scenarios have MOEs >300. For intermediate-term dermal exposure, only 2 scenarios with engineering controls have risk estimates (MOEs) greater than or equal to 100. For short-term dermal exposures, the following scenarios have MOEs >100: 1 scenario using baseline protection, 7 scenarios using additional PPE, and 13 scenarios using engineering controls.

The formula used to combine the dermal and inhalation risks is the Aggregate Risk Index, because the dermal and inhalation exposures have different acceptable Margins of Exposure (MOEs); for dermal MOEs at or greater than 100, and for inhalation, all time periods, MOEs at or greater than 300:

For Combined dermal and inhalation exposure risk estimates:

$ARI = MOE_{calculated} / MOE_{acceptable}$
$ARI_{dermal} = MOE_{calculated\ dermal} / MOE_{acceptable\ dermal}$
$ARI_{inhalation} = MOE_{calculated\ inhalation} / MOE_{acceptable\ inhalation}$

$$Aggregate Risk Index (ARI) = \frac{1}{\frac{1}{ARI_{dermal}} + \frac{1}{ARI_{inhalation}}}$$

Using this formula, the combined dermal and inhalation risks were calculated for exposure scenarios for which maximum PPE and/or engineering controls were available to control both dermal and inhalation exposures. Risk estimates are given in Tables 6 and 7 below, all ARIs below 1, exceed HED's level of concern.

In summary, 10 exposure scenarios have Aggregate Risk Indexes (ARIs) at or above one; therefore they do not exceed HED's level of concern for dermal and inhalation exposure combined risks. HED has combined dermal and inhalation risk estimates for those dermal exposure scenarios which individually have dermal MOEs at or greater than 100. Since all other dermal exposure scenarios result in MOEs <100, aggregating dermal and inhalation risks for these scenarios will also result in these scenarios having calculated ARIs below one; which exceeds HED's level of concern. The 10 scenarios that have ARIs above or equal to one are:

With PPE

4 (f) Applying sprays/liquid with hand-gun lawn sprayers,@ 0.25 lbs ai/Acre;
7 (a) M/L/A liquids with low pressure hand-wands, @ 0.25 lbs ai/Acre;

With Engineering Controls:

For short-term Exposures:

1(c) Mixing/loading liquids for airblast sprayers, @ 0.25 lbs ai/Acre
1(d) Mixing/loading liquids for rights-of-way sprayers, @ 0.25 lbs ai/Acre
1(e) Mixing/loading liquids for high pressure hand-wands, @ 0.01 lbs ai/gallon
3) Loading granules for tractor-drawn broadcast spreaders, @ 0.25/1.0 lbs ai/Acre
4(b) Applying sprays/liquids with groundboom sprayers, @ 0.25 lbs ai/Acre
5) Applying granules with tractor-drawn broadcast spreaders, @ 0.25/1.0 lbs ai/Acre
6) Flagging in support of aerial spray applications, @ 0.25/1.0 lbs ai/Acre

For intermediate- and long-term Exposures:

3) Loading granules for tractor-drawn broadcast spreaders, @ 0.25 lbs ai/Acre

Table 6. Combined Risk Estimates for Short-term Dermal and Inhalation Exposure Scenarios (MOEs).			
Scenarios	Dermal Risk Estimates	Inhalation Risk Estimates	Combined Risk Estimates (ARIs)
With Baseline Protection			
3) @ 0.25 lbs ai/Acre	100	53	0.15
With Additional PPE			
1(c) @ 0.25 lbs ai/Acre	100	760	0.72
1(d) @ 0.25 lbs ai/Acre	100	760	0.72
1(e) @ 0.01 lbs ai/gallon	100	760	0.72
3) @ 0.25 lbs ai/Acre	260	270	0.67
4 (f) @ 0.25 lbs ai/Acre	120	8700	1.15
5) @ 0.25 lbs ai/Acre	210	380	0.79
7 (a) @ 0.25 lbs ai/Acre	190	1200	1.3
With Engineering Controls			
1(b) @ 0.25 lbs ai/Acre	100	1100	0.79
1(c) @ 0.25 lbs ai/Acre	200	2200	1.6
1(d) @ 0.25 lbs ai/Acre	200	2200	1.6
1(e) @ 0.01/0.02 lbs ai/gallon	200 / 100	2200 / 1100	1.6 / 0.79
3) @ 0.25/1.0/4.0 lbs ai/Acre	5200 /1300 / 320	2700 / 670 / 170	7.7 / 1.9 / 0.48
4(b) @ 0.25 lbs ai/Acre	180	2100	1.4
5) @ 0.25/1.0 lbs ai/Acre	420 / 100	410 / 100	1.03 / 0.29
6) @ 0.25/1.0 lbs ai/Acre	910 / 230	3000 / 740	4.8 / 1.2

Table 7. Combined Risk Estimates for Intermediate- and Long-term Dermal and Inhalation Exposure Scenarios (MOEs).			
Scenarios w/ Engineering Controls	Dermal Risk Estimates	Inhalation Risk Estimates	Combined Risk Estimates (ARIs)
3) @ 0.25 lbs ai/Acre	410	2700	2.8
3) @ 1.0 lbs ai/Acre	100	670	0.69

(e). Occupational Post-application Risk Estimates

Short-term and intermediate-term post-application occupational exposures may occur dermally, but not through inhalation. Post-application exposures of 1 to 7 days are considered short-term; post-application exposures of 1 week to several weeks are considered intermediate-term.

Agricultural Crops (MRID Nos. 402029-02, and 404666-01):

Risk estimates (MOEs) and associated reentry intervals (REIs) for occupational post-application short-term and intermediate-term dermal exposures assuming 100% dermal absorption, are provided in Table 8 [Based on the registrants chemical specific study data for agricultural crops (MRID Nos. 402029-02, and 404666-01)]. REIs are based on when the MOE is 100 for short- and intermediate-term dermal exposures. The risk estimates and REIs were calculated for tree crops (citrus), grapes (using citrus data), and low potential exposure crops (using cabbage data). Low potential exposure crops include low-growing crops like lettuce and broccoli. The risk estimates were based on dislodgeable foliar residue (DFR) data for tree crops and cabbage. The risk estimates (MOEs) and REIs are based on harvesting activities with transfer coefficients of 10,000 cm^2/hour for tree crops (citrus), 15,000 cm^2/hour for grapes, and 2,500 cm^2/hour for crops with a low exposure potential. DFR values are for diazinon only; no metabolites were included in the analyses. DFR values and calculated dermal doses for the three crop types at different intervals are provided in Table 8.

The dermal dose was calculated through the following equation:

Dermal dose in (mg/kg/day) = {[DFR ($\mu g/cm^2$)] transfer coefficient (T_c) * 8 hours worked per day * 0.001 mg/μg conversion * 1.0 (100% dermal absorption correction factor) / 70 kg body weight}.*

The Margin of Exposure was calculated as:

MOE = NOEL (mg/kg/day)/Dermal Dose (mg/kg/day),

where for short-term exposures defined as 0 to7 days, a NOAEL = 0.25mg/kg/day was used; for 8 to 9 day exposures, both short-term and intermediate-term toxicity endpoints were used, and for intermediate-term exposures of 13 to 23 days duration, a NOAEL of 0.02 mg/kg/day was used.

Table 8 reports a range of MOEs for various days after treatment (DATs) assuming 100 percent dermal absorption and various DFR values for trees, grapes, and low potential exposure crops. Available DFR data on citrus were adjusted by a factor of 3 to estimate DFR values on grapes treated at 1 lb ai/A, the maximum labeled rate. Residue levels from submitted DFR studies were used to extrapolate DFR values below the limit of detection (< LOD). For tree crops, based on the maximum application rate (3 lb ai/A), short- and intermediate-term MOEs are less than 12 for residues greater than or equal to the LOD. Extrapolating, DFR values for tree crops reach ½ the LOD (0.002 $\mu g/cm^2$) **at 15 days after treatment, and the MOE is 6.2.** HED notes that reentry intervals (REIs) could not be established for short- and intermediate-term exposures incurred through harvesting activities associated with tree crops.

For grapes, based on the maximum application rate (1 lb ai/A), short- and intermediate-term MOEs are less than 25 for residues greater than or equal to the LOD. Extrapolating, DFR values

for grapes reach ½ the LOD (0.002 μg/cm^2) **at 11 days after treatment, and the MOE is 5.6.** HED notes that reentry intervals (REIs) could not be established for short- and intermediate-term exposures incurred through harvesting activities associated with grapes.

For low potential exposure crops (e.g., cabbage, lettuce), based on the minimum application **rate of 0.25 lb ai/A**:

For Short-Term exposures,

MRID Study No. 404666-01; residues are at 0.0078 μg/cm^2 (at 1 DAT)
residues are at 0.0058 μg/cm^2 (at 2 DAT) ;

MRID Study No. 402029-02; residues are at 0.044 μg/cm^2 (at 1 DAT)
residues are at 0.012 μg/cm^2 (at 2 DAT)
residues are at 0.0053 μg/cm^2 (at 3 DAT)

The REI is established at the minimum application rate (0.25 lb ai/A) for low potential exposure crops after three days of application (at 3 DAT, MOE =170).

Essentially, for all post-application dermal exposure scenarios associated with tree crops and grapes, DFR levels must be extrapolated below ½ of the LOD before MOEs greater than or equal to 100 can be achieved. DFR values at ½ of the LOD and associated days after treatment (DAT) have been bolded in Table 8.

The information submitted by the registrant to support a 3.85 percent dermal absorption factor is insufficient (DP Barcode: D238960, November 30, 1999). The study submitted had the following citation: Wester, R.C., et al., "Percutaneous absorption of diazinon in humans", Food Chemistry and Toxicology, Volume 31, No. 8, pp. 569-572, 1993. Specifically, detailed information on the material tested, material dosed, method of application, sample collection, observations and control of the human test subjects, and analysis of data were lacking. HED recommends the appropriate information be organized, properly formatted, and resubmitted to the Agency for review before a determination as to the validity of the dermal absorption factor can be considered further.

Table 8 . Occupational Post-application Short- and Intermediate-term Risks and Estimated REIs for Diazinon – Assuming 100 percent Absorption									
Days After Treatment (DAT)	**Tree Crops - 3 lbs ai/A[a]**			**Grapes - 1.0 lb ai/A[a]**			**Low Potential Exposure - typical- mid range rate of 2.0 lb ai/A[a]**		
	DFR (μg/cm^2)[b]	**Dermal Dose (mg/kg/day)[c]**	**MOE[d]**	**DFR (μg/cm^2)[b]**	**Dermal Dose (mg/kg/day)[c]**	**MOE[d]**	**DFR (μg/cm^2)[b]**	**Dermal Dose (mg/kg/day)[c]**	**MOE[d]**
0	0.12	0.14	1.8	0.040	0.069	3.6	0.080	0.023	11
1	0.093	0.11	2.4	0.031	0.053	4.7	0.062	0.018	14
2	0.069	0.079	3.2	0.023	0.039	6.3	0.046	0.013	19
3	0.0537	0.061	4.1	0.0179	0.031	8.1	0.0358	0.010	25
4	0.0411	0.047	5.3	0.0137	0.023	11	0.0274	0.008	31
5	0.0315	0.036	6.9	0.0105	0.018	14	0.0210	0.006	42
6	0.024	0.027	9.1	0.008	0.014	18	0.016	0.0045	56
7	0.0183	0.021	12	0.0061	0.010	24	0.0122	0.0035	71
8	0.0140	0.016	16 (S)/1.2(I)	0.00468	0.0080	31(S)/2.5(I)	0.0094	0.0026	96(S)/7.7(I)
9	0.0107	0.012	21 (S)/1.6(I)	0.00358	0.0061	41(S)/3.3(I)	0.0072	0.0020	120(S)/10(I)
10	0.0082	0.0094	2.1	0.00274	0.0047	4.3	0.0055	0.0016	12
11	0.0063	0.0072	2.8	**0.0021**	**0.0036**	**5.6**	0.0042	0.0012	17
13	0.0036	0.0042	4.8	0.0012	0.0021	9.6	0.0024	0.0007	29
15	**0.0022**	**0.0025**	**6.2**	0.00072	0.0012	16	0.0014	0.00041	49
16	0.0016	0.0019	11	0.00055	0.00094	21	**0.0011**	**0.00032**	**62**
19	0.00072	0.00082	8.1	0.00024	0.00041	47	0.00048	0.00014	140
22	0.00033	0.00038	53	0.00011	0.00019	110	-	-	-
25	0.00015	0.00017	120	0.000049	0.000084	240	-	-	-

Note: Rounding errors, calculations were performed on a spreadsheet.

[a] = Activity is based on harvesting with transfer coefficients (T_c) of 10,000 cm^2/hour for tree crops, 15,000 cm^2/hour for grapes, and 2,500 cm^2/hour for low exposure potential crops.
[B] = Citrus DFR values (MRID 404666-01; LOD = 0.004 ug/cm^2) used for tree crops and grapes. Cabbage DFR values (MRID 402029-02; LOD = 0.002 ug/cm^2) are used to represent low potential exposure crops.
[C] = Dermal Dose (mg/kg/day) ={[DFR (μg/cm^2)]* transfer coefficient (T_c) * 8 hours worked per day * 0.001 mg/μg conversion * 1.0 (100% dermal absorption correction factor) / 70 kg body weight}.
[D] = MOE = NOEL (mg/kg/day)/Dermal Dose (mg/kg/day), where *for short-term (0-7 days) dermal, NOAEL = 0.25mg/kg/day was used; for days 8, and 9-both Short-term(S) and Intermediate-term (I) toxicity endpoints. were used, for intermediate-term (13-23 days where applicable), NOEL = 0.02 mg/kg/day was used.*

Uncertainties in this analysis include: the use of 100 percent dermal absorption; the use of a linear extrapolation applied to the DFR values from the study application rate (1 lb ai/A) to the maximum labeled rate (3 lbs ai/A) for tree crops; and the use of the citrus DFR values once adjusted for differences in application rates between citrus and grapes to estimate exposure from grapes. The use of 100 percent dermal absorption may overestimate the risks. The effect of extrapolating the citrus DFR data to a higher application rate and using it to represent grape leaves is unknown and may under- or overestimate the actual residue levels. An acceptable dermal absorption study would allow refinement of the dermal exposure and risk estimates. The significant difference between the current REI on the diazinon labels (24 hours), that listed for California (5 days for some crops), and those estimated by the Agency is attributed to HED's use of plasma ChE as the toxicological endpoint (i.e., short-term of 0.25 mg/kg/day, and intermediate-term of 0.02 mg/kg/day and an uncertainty factor of 100).

Greenhouse Ornamentals:

MRID # 443488-02, -03, -04 &, -06.

MRID #443488-02

This report reviews *Exposure Monitoring in Greenhouses-Diazinon (G24480)*, submitted in support of re-registration requirements for the insecticide product, BASUDIN® 600 EW. Ciba-Geigy Ltd. Sponsored a study in which BASUDIN® 600 EW, containing the active ingredient (a.i.) diazinon, was applied using handheld spray equipment to roses grown in commercial greenhouses. The study was performed according to the FAO's Guidelines on Producing Pesticide Residue Data from Supervised Trials (Roma, 1990). **The study was not designed to meet the requirements of the U.S. EPA's Post-Application Exposure Monitoring Test Guidelines.**

Three sample sets were developed in this study: (1) ambient air samples; (2) DFR samples; and (3) dermal dosimetry samples. Applicator exposure was not assessed; reentry worker exposure was the focus of this study.

The ambient air and dermal dosimetry sampling data could not be used from this study. The ambient air and dermal dosimetry sampling data are not of sufficient quality to be used in a risk assessment. The ambient air sampling should have been conducted at the workers breathing zone instead of as area ambient air, then worker breathing zone air concentrations should have all collected replicates averaged at the same time intervals, and then converted to $\mu g/m^3$. Also, dissipation of diazinon residues within air and from foliar surfaces in greenhouses is mainly determined by air exchange between greenhouses and the outside environment. In this study, the plastic walls of the greenhouse were rolled up periodically to relieve high temperatures from building up inside. When this occurred, and for how long, was not reported. Without this information, the **validity** of ambient air sampling results from this study **is questionable**.

Greenhouse workers' re-entry (post-application) Exposure/Dose and MOEs were not calculated from these DFR values (Table 9), because of the dissipation of residues over time

(rate) from both greenhouses (#2 and #3) does not agree with other such data available. In various other diazinon DFR studies (i.e. MRID Nos. 402029-02 & -03, and 404666-01), the dissipation for diazinon residues from outdoor agricultural crops is much slower. For example, the extrapolation of the DFR residue values for citrus crops to low exposure potential crops at an application rate of 0.25 lb. ai/Acre (MRID Nos.402029-02, and 404666-01) resulted in MOEs greater than 100, three days after treatment in an outdoor environment. It is expected that residues would dissipate much more slowly in an indoor environment. Therefore dissipation of diazinon residue levels corresponding to a MOE of 100 **would not be expected for at least 8 -10 days after treatment** [due to the higher application rate (0.58 lb ai/A), and an indoor environmental atmosphere.].

MRID #443488-03

This study titled, "An Assessment of Exposure to Workers Re-entering Greenhouses Containing Diazinon Treated Plants", does not provide any chemical specific raw data for diazinon. This study is based on another Novartis insecticide, CGA-215944, a dermal absorption rate of 3.85%, and a transfer coefficient of 9,000 cm^2/hr. The calculated absorbed dose is 0.0936 mg/kg/day, for workers re-entering treated greenhouses, for 6 hours only, and weighing 60kg.

The maximum diazinon application rate for use on ornamentals is 1.5 lbs. ai/100 gallons of water per the registrant, Novartis (this is the maximum application rate on the AG600 WBC label, EPA Reg. # 100-784). Applications are to be made as soon as the presence of target pests is observed and spray should penetrate foliage and coat the undersides of leaves. Applications made to container greenhouse plants are typically made at gallonages ranging from 100-300 gallons per acre. A concentration application at 100 gallons per acre, equivalent to 1.5 lbs. ai/A was used in this (and the Agency's) diazinon exposure risk assessment. Using the rate of application to 0-hour dislodgeable residue, 0.34 lbs. ai/A to 0.612 $\mu g/cm^2$, results in a conversion factor of 1.8 0 $\mu g/cm^2$ /lb. ai/A. This conversion factor compares favorably with one of 2.0 $\mu g/cm^2$ /lb. ai/A calculated using foliar dislodgeable residues from five locations at time 0 from a 1992 profenofos cotton study. Theoretically, diazinon dislodgeable residue at time 0 after an application rate of 1.5 lbs. ai/A, would be: (1.5 lbs. ai/A) X (1.8 $\mu g/cm^2$ /lb. ai/A) = **2.7 $\mu g/cm^2$** (True Maximum application rate on the label = 1.5 lbs. ai/100 gal X 300 gallons/Acre = 4.5 lbs. ai/A).

Worker exposures were calculated two different ways, one scenario was presented in the study by the registrant (which assumes 3.85% dermal absorption) and the second scenario is calculated by the Agency based on eight hours worked and 100 % dermal absorption is assumed (the same transfer coefficient was used in each scenario that was provided by the registrant). Utilizing the registrant's calculated Dose [of an application rate of 1.5 lbs. ai/A (this is not at the maximum application rate), assuming 3.85% dermal absorption, and 60 kg body weight], and then dividing it into the Agency's dermal short-term NOAEL toxicological end point of 0.25 mg/kg/day, **MOEs are below 5**.

Re-entry greenhouse worker exposure immediately following application (as soon as sprays have dried) is calculated as follows **(@ appl. rate = 1.5 lbs. ai/Acre, this is not the maximum rate, which is 4.5 lbs. ai/Acre and 3 times greater than the lower rate used/presented in this**

study's risk assessment):

Registrant's Calculated Dermal Dose: Dose = [DFR (2.7 μg/cm ^{2}) X (0.001 mg/μg) X 9,000 cm^2/hr X 6 hours X 0.0385]/ 60kg = 0.0936 mg/kg/day, MOE = 0.25/Dose = 2.7.

Agency's Calculated Dermal Dose: Dose = [DFR (2.7 μg/cm ^{2}) X (0.001 mg/μg) X 9,000 cm^2/hr X 8 hours X 1(100% DA)]/70kg = 2.78 mg/kg/day **[MOE = 0.25 mg/kg/day (Short-Term Dermal end point)/2.78 mg/kg/day = 0.09]**

Conclusion

The registrant also states that when greenhouse workers wear long sleeved shirts, they have a protection factor of 90% for the arms. The registrant incorporated this reduction factor in their calculations, thus reducing the absorbed dose. The registrant also feels with the use of both, gloves and long-sleeve shirts, the dose would be reduced by 90%, resulting in 0.00936 mg/kg/day (the Agency's calculated MOE for this dose is 0.25 mg/kg/day (dermal short-term NOAEL)/ 0.00936 mg/kg/day = 27; which still exceeds HED's level of concern (MOEs below 100). The Agency does not consider Re-entry workers to be required to wear any additional Personal Protective Equipment (PPE), other than long sleeved shirts, long pants, shoes and socks; therefore a reduction on the hands would not be considered. A **Restricted Entry Interval (REI)** is used to protect workers from post-application exposure (not additional PPE) by only allowing them to re-enter areas that have been treated with a pesticide when residues are minimized to levels that do not exceed the Agency's level of concern (for Diazinon, that means calculated MOEs above 100 for dermal exposure).

MRID #443488-04

This study titled, Assessment of Exposure to Workers Re-entering Greenhouses Containing Diazinon Treated Plants, <u>does provide chemical specific raw data for diazinon</u>. In this study it is stated that **inhalation exposures** to greenhouse workers were inadvertently omitted from the exposure assessment study conducted in South America in Suba, Columbia (MRID # 443488-02); therefore this study addresses inhalation exposures to workers re-entering greenhouses. It is stated that three greenhouses were treated with an emulsifiable concentrate formulation of diazinon at a rate of 0.99 to 1.1 lb ai/acre [the Agency's calculated application rate (estimated to be 0.58 lbs. ai/A) for the registrant's Study MRID # 443488-02, was based on the AG600 WBC label, because the registrant did not provide a label for Basudin 600 EW]. Air residues in the greenhouses were monitored using personal air-sampling pumps calibrated to 0.5 liters per minute that were connected to sampling tubes containing a glass fiber filter, a sorbent, and polyurethane foam; three air-sampling tubes were placed in the workers breathing zone; samples were collected prior to application and at five intervals after application. Average diazinon residues ranged from 39 µg/m^3 at 1.4 to 2.3 hours after application to 0.8 µg/m^3 at 66 to 75 hours after application. Using a ratio (39/1 = x/1.5) to extrapolate the expected residues following an application at the 1.5 lbs. ai/ acre used to calculate dermal exposure, the expected

residue would be 59 µg/m^3. *Using the ratio (39/1 = x/0.58) to extrapolate the expected residues following an application at the 0.58 lbs. ai/ acre used to calculate dermal exposure, the expected residue would be 22.62 µg/m^3.*

In a conservative approach (based on the registrant), inhalation exposure was calculated using 59 µg/m^3, even though the restricted entry interval (REI) to ornamentals is 12 hours for diazinon, at which time the measured air residues were 16 µg/m^3 (a reduction of 73%; therefore for an application rate @ 0.58 lbs. ai/A, the air residues have decreased to 6.1 µg/m^3). Inhalation exposure was calculated using 8.4 m^3 (The Agency utilizes 15.2 m^3/day for 8 hours , for males during long-term exposures, per 1997-Exposure Factors Handbook) as the volume of air respired by a human adult during light exercise over a 6 hour period.

Registrant's Calculation [The registrant's calculated Dose was divided into the Agency's inhalation toxicological end-point, LOAEL = 0.026 mg/kg/day, for all time periods. The MOEs (are below 20) still exceed HED's level of concern, which are MOEs below 300].

Inhalation Exposure (@ an appl. **rate = 1.5 lbs. ai/ A**): (59 µg/m^3 * 8.4 m^3) / 70kg = 7.08 µg/kg/day [*this equates to a MOE = (0.026 mg/kg/day*- Agency's Inhalation LOAEL */ 0.0071 mg/kg/day) = 3.7*].

The registrant states this is calculated based on immediate re-entry into treated greenhouses and assuming the worker is in contact with treated plants for 6 hours.

Inhalation Exposure 12 hours after application: (16 µg/m^3 * 8.4 m^3) / 70kg = 1.9 µg/kg/day [*this equates to a MOE = (0.026 mg/kg/day/ 0.0019 mg/kg/day) = 14*].

Agency's Calculation based on an application **rate of 0.58 lbs. ai/A** (MRID# 443488-02)

Inhalation Exposure: (22.6 µg/m^3 * 15.2 m^3) / 70kg = 4.9 µg/kg/day [*this equates to a MOE = (0.026 mg/kg/day / 0.0049 mg/kg/day) = 5.3*].

The above calculation is based on immediate re-entry into treated greenhouses and assuming the worker is in contact with treated plants for 8 hours.

Inhalation Exposure 12 hours after application: (6.1 µg/m^3 * 15.2 m^3) / 70kg = 1.3 µg/kg/day [*this equates to a MOE = (0.026 mg/kg/day/ 0.0013 mg/kg/day) = 20*].

All calculated post-application inhalation exposures/Doses from application rates of 0.58 & 1.5 lbs. ai/A of workers re-entering greenhouses that have been treated with diazion ***(all MOEs are less than 21) exceed HED's level of concern (MOEs less than 300 for inhalation)***.

MRID #443488-06

This study titled, Risk Assessment For Indoor Diazinon Uses, does not provide any chemical specific raw data for diazinon. This study is based on an evaluation of potential risk

associated with applicator exposure and post-application exposure resulting from the indoor residential and greenhouse uses of diazinon.

Risk Assessments:

Risk Associated with Exposure to Greenhouse Workers Entering Diazinon Treated Greenhouses

This assessment was based on the same study cited under the MRID # 443488-03. The registrant used a dermal absorption rate of 3.85%, and a transfer coefficient of 9,000 cm^2/hr. The calculated absorbed dose is 0.0936 mg/kg/day, for workers re-entering diazinon-treated greenhouses, for 6 hours only, and weighing 60kg. The Agency's calculated absorbed dose is based on 100 % dermal absorption, 70kg, and it is equaled to 2.08 mg/kg/day [MOE = (0.25 mg/kg/day-short-term dermal NOAEL / 2.08 mg/kg/day) 0.12].

See the above MRID Study # 443488-04, for details pertaining to the inhalation dose estimates for this greenhouse scenario.

Inhalation Exposure calculated based on immediate re-entry into treated greenhouses and assuming the worker is in contact with treated plants for 6 hours: (59 µg/m^3 * 8.4 m^3) / 70kg = 7.08 µg/kg/day [*this equates to a MOE = (0.026 mg/kg/day*-Agency's Inhalation LOAEL*/ 0.0071 mg/kg/day) = 3.7*].

Inhalation Exposure 12 hours after application: (16 µg/m^3 * 8.4 m^3) / 70kg = 1.9 µg/kg/day [*this equates to a MOE = (0.026 mg/kg/day/ 0.0019 mg/kg/day) = 14*].

All calculated post-application exposures/doses (all MOEs are less than 15) for workers re-entering diazinon treated greenhouses ***exceed HED's level of concern (MOEs less than100 for dermal, and MOEs less than 300 for inhalation)***.

Table 9. Predicted Greenhouse (#2 and #3) Average DFR ($\mu g/cm^2$) values for Cultivation Work and Harvesting of Roses (MRID # 443488-02)			
@ 0.58 lbs. ai/A			
Hours after application.	DFR Greenhouse #2	DFR Greenhouse #3	DFR Avg. of Both Grn-Hses
0	0.97	0.87	0.92
1	0.92	0.81	0.87
2	0.87	0.75	0.81
3	0.83	0.70	0.77
4	0.79	0.65	0.72
5	0.75	0.60	0.68
6	0.72	0.56	0.64
7	0.68	0.52	0.60
8	0.65	0.48	0.56
9	0.62	0.45	0.53
10	0.59	0.41	0.50
11	0.56	0.38	0.47
12	0.53	0.36	0.44
13	0.51	0.33	0.42
14	0.48	0.31	0.39
15	0.46	0.28	0.37
16	0.44	0.26	0.35
17	0.41	0.24	0.33
18	0.39	0.23	0.31
19	0.38	0.21	0.29
20	0.36	0.20	0.28

Note : 1) Because the LOD and LOQ were not specified, the Agency assumed that the LOQ was at the laboratory's lowest fortification level (0.01 μg ai/ml or 0.002 µg/cm^2) for regression analyses.
2) Rounding errors, calculations were performed on a spreadsheet.

(f.) Residential Exposure and Risk Estimates

(i). Homeowner Handlers Exposure

Diazinon has a wide variety of homeowner uses including lawn treatments, spot treatments, and indoor carpet treatments. Diazinon is applied by many methods including spray equipment, and granular spreaders. All residential handler use patterns are considered to result in short-term exposures. HED has conducted screening-level assessments for 7 residential exposure scenarios resulting from diazinon's registered uses. Because there are no handler residential exposure chemical specific data available, the residential risk assessments are based on the Residential Standard Operating Procedures (SOPs), December 1997 version, and HED standard assumptions for the area treated per day. Based on the available data, 100% dermal absorption was assumed for those assessments involving dermal exposures. The caveats and parameters specific to each residential handler exposure scenario are summarized in Table 10. Risk estimates are provided in Tables 10(a), 10(b), and 10(c) [based on the MRID No. 449591-01]. The restriction on current labels for non-agricultural uses that are out of the scope of the Worker Protection Standard is, *"Do not enter or allow entry into treated areas until sprays have dried. Do not permit children or pets to go onto sprayed grass until spray has completely dried."*

Residential handler scenarios are as follows:

1R. Applying liquids with a paintbrush.
2R. Applying liquids with an airless sprayer.
3R. Mixing/loading/applying liquids with a low pressure handwand.
4R. Mixing/loading/applying liquids with a backpack sprayer.
5R. Mixing/loading/applying liquids with a garden hose-end sprayer.
6R. Loading/applying granules with a belly grinder.
7R. Loading/applying with a push-type spreader.

Residential exposure assumptions are from HED's Draft Residential Standard Operating Procedures (SOPs), December 1997 version. The Residential Unit Exposure numbers are derived from the Pesticide Handler Exposure Database (PHED) Version 1.1. Dermal Unit Exposures are based on homeowner applicators wearing short sleeve shirts and short pants, and no gloves (sss, sp, ng) open mixing/loading; and open cab tractor; except for backpack sprayers. Chemical resistant gloves are included for the backpack assessment because the "no glove" scenario is not available; therefore a 90% protection factor (PF) was used. To account for the "no glove" scenario, a back calculation was conducted to obtain the appropriate unit exposure value for a no glove scenario for backpack application. Inhalation Exposure Unit estimates assume no respirator.

Table 10 . Diazinon Handler Residential SOP (Derived from PHED V1.1) Unit Exposures [a]											
Exposure Scenario Equipment / Usage	**Dermal Unit Exposure (mg/lb ai) (dermal+hands)**	**Dermal Data Confid.**	**Derm. Grades**	**Derm. Repli.**	**Hand Grade**	**Hand Repli.**	**Clothing [b] Scenario**	**Inhalatn. Unit Exposure (ug/lb ai)**	**Inhalatn. Data Confid.**	**Inhalatn. Grades**	**Inhalation Repli.**
Applicator											
Applying sprays / liquids											
Scenario # 1R Paintbrush	230	Low	C	14-15	B	15	SSS, SP, NG	280	Medium	C	15
Scenario # 2R Airless Sprayer	79	High	B	15	B	15	SSS, SP, NG	830	Medium	C	15
Mixer/Loader/Applicator											
Mixing/loading/applying liquids											
Scenario # 3R Low Pressure Handwand	100	Low	ABC	8-9	All	70	SSS, SP, NG	30	Medium	ABC	80
Scenario # 4R Backpack sprayer	5.1	Low	AB	9-11	C	11	SSS, SP, NG	30	Low	A	11
Scenario # 5R Garden hose-end sprayer	30	Low	C	8	E	8	SSS, SP, NG	9.5	Low	C	8
Loading/applying granules											
Scenario # 6R Belly Grinder	110	Medium	ABC	20-45	ABC	23	SSS, SP, NG	62	High	AB	40
Scenario # 7R Push-type spreader (Head& neck data is not available)	3	Low	C	0-15	C	15	SSS, SP, NG	6.3	High	B	15

[a] = The Pesticide Handler Exposure Database (PHED) Version 1.1, and SOPs- for Residential Exposure Assessments Guide (August, 1997)
[b] = Dermal Unit Exposure is based on workers wearing short sleeve shirts and short pants, and no gloves (SSS, SP, NG).
Inhalation Unit Exposures represent no respirators.

(ii). Homeowner Handler Risk Estimates

The target margin of exposure (MOE) is 100 for handler short-term dermal residential exposures to diazinon by homeowner handler/applicators. For residential handler inhalation exposures of any duration, the target MOE is 300. Estimated risks, expressed as MOEs, for all residential handler scenarios are less than 100, and exceed HED's level of concern. Exposure and risk estimates for these scenarios can be found in Tables 10(a), 10(b), and 10(c). HED anticipates that aggregating exposures, dermal plus inhalation, from residential handlers would only result in risk estimates that would further exceed HED's level of concern.

A range of application rates were used in the exposure assessments to provide a range of exposure and risk estimates across various residential uses of diazinon. Specifically, the exposure and risk estimates presented in Table 10(a) under the headings "minimum", "typical", and "maximum" are based on an application rate of 0.01, 0.02, and 0.08 lbs ai/gallon, respectively. These application rates are believed to represent the low end of the range of application rates for diazinon products with residential uses, and correspond to labeled rates for wettable powder formulations used on beans, beets and broccoli, i.e., crops with a low exposure potential. In Table 10(b), the exposure and risk estimates presented under the headings "minimum", "typical", and "maximum" are based on an application rate of 0.20, 2.0, and 5.0 lbs ai/gallon **or** 0.25, 1.0, and 4.0 lbs ai/Acre, respectively. In Table 10(c), The exposure estimates for two formulations (granular and liquid) used on residential turf (application rates = Granular-4.4 lbs ai/A, & Liquid-4 lbs ai/A), are based on the registrants chemical specific Turf Transferable Residue (TTRs) Study (MRID No. 449591-01). These application rates are believed to represent the highest of the range of application rates for diazinon products with residential uses, and correspond to labeled rates for formulations used in indoor/outdoor environments with a high exposure potential. Regardless of the application rates used in the exposure assessment, risk estimates expressed as MOEs; for dermal exposure scenarios for residential handlers of diazinon, separately, are all below 100 (<47), and exceed HED's level of concern. If combined, dermal and inhalation exposures would further exceed HED's level of concern. All calculations presented in the tables are based on the following formulas:

*Daily Dermal Dose (mg/kg/day) = {[Unit Exposure (mg/lb ai) * Appl. rate (lb ai/acre or per gallon) * Acres or gallons treated]* 1 (100% dermal absorption correction factor)/ 70kg BW}.*

*Daily Inhalation Dose (mg/kg/day)= [{Unit Exposure (µg/lb ai) * (1mg/1000 µg) Conversion * Application Rate (lb ai/A or per gallon) * Acres or gallons treated /day} / 70kg bw].*

Table 10a. Residential Handler (exposures are short-term only) MOEs are based on, application rates of "minimum"- 0.01, "typical"- 0.02, and "maximum" -0.08 lbs ai/gallon						
Exposure Scenarios Equipment /Usage	**Dermal Baseline [ac]**			**Inhalation Baseline [bc]**		
	Min.	**Typical**	**Max.**	**Min.**	**Typical**	**Max.**
Applying sprays / liquids						
Scenario #1R -Paintbrush	7.6	3.8	0.95	650	320	81
Scenario #2R - Airless Sprayer	1.5	0.74	0.18	15	7.3	1.8
Mixing/loading/applying liquids						
Scenario #3R - Low Pressure Handwand	NA	NA	NA	NA	NA	NA
Scenario #4R -Backpack sprayer	NA	NA	NA	NA	NA	NA
Scenario #5R - Garden hose-end sprayer	NA	NA	NA	NA	NA	NA
Loading/applying granules						
Scenario #6R - Belly Grinder	NA	NA	NA	NA	NA	NA
Scenario #7R -Push-type spreader	NA	NA	NA	NA	NA	NA

[a] Baseline dermal unit exposures represent short pants, short sleeved shirt, no gloves, during open mixing/loading, and application..

[b] Baseline inhalation unit exposures represent no respirator.

[c] Application rates are a range of representative and maximum rates values found in the diazinon labels. The following labels were used to determine the rates:
(1) Wettable powders - EPA Reg. No. 100-460 (Diazinon 50 W). Min. rate represents beans, beets, broccoli, etc. Max. rate represents beans, beets, broccoli, etc.
(2) Liquid formulations - EPA Reg. Nos. 100-784 (AG600 WBC) and 100-461 (AG500 emulsifiable solution). Min. rate represents apricots, beets, etc. Max. rate represents beans, etc. Rights-of-way rate is located on the EPA Reg. No. 100-461.
(3) Granular - EPA Reg. No. 100-469 (Diazinon 14G) and Diazinon Granular Lawn Insect Control (2 percent).
Daily acres treated values are from the EPA HED estimates of acreage that could be treated in a single day for each exposure scenario of concern. The granular lawn area is restricted to a maximum of 15,000 ft2 (EPA Reg. No. 100-468).

NA= Not Applicable to this scenario.

Table 10b. Residential Handler (exposures are short-term only, and based on the default acreage = 0.5A, except for granular form'n.) MOEs (see application rates within foot notes)						
Exposure Scenarios Equipment /Usage	**Dermal Baseline [ac]**			**Inhalation Baseline [bc]**		
	Min.	**Typical**	**Max.**	**Min.**	**Typical**	**Max.**
Applying sprays / liquids						
Scenario #1R -Paintbrush	0.38	0.038	0.015	32	3.2	1.3
Scenario #2R - Airless Sprayer	0.074	0.0074	0.003	0.73	0.073	0.029
Mixing/loading/applying liquids						
Scenario #3R - Low Pressure Hand-wand	1.4	0.35	See Table 10(c)	480	120	See Table 10(c)
Scenario #4R -Backpack sprayer	29	7.1	1.8	480	120	30
Scenario #5R - Garden hose-end sprayer	4.7	1.2	See Table 10(c)	1500	380	See Table 10(c)
Loading/applying granules						
Scenario #6R - Belly Grinder	1.9	0.46	See Table 10(c)	340	85	See Table 10(c)
Scenario #7R -Push-type spreader (Head& neck data is not available)	85	17	See Table 10(c)	3300	840	See Table 10(c)

[a] Dermal unit exposures represent short pants, short sleeved shirt, no gloves, during open mixing/loading, and application..

[b] Inhalation unit exposures represent no respirator.

[c] Application rates are a range of representative and maximum rates values found in the diazinon labels. The following labels were used to determine the rates:

(1) Wettable powders - EPA Reg. No. 100-460 (Diazinon 50 W). Min. rate represents beans, beets, broccoli, etc. Max. rate represents beans, beets, broccoli, etc.
(2) Liquid formulations - EPA Reg. Nos. 100-784 (AG600 WBC) and 100-461 (AG500 emulsifiable solution). Min. rate represents apricots, beets, etc. Max. rate represents beans, etc. Rights-of-way rate is located on the EPA Reg. No. 100-461.
(3) Granular - EPA Reg. No. 100-469 (Diazinon 14G) and Diazinon Granular Lawn Insect Control (2 percent).
Daily acres treated values are from the EPA HED estimates of acreage that could be treated in a single day for each exposure scenario of concern. The granular lawn area is restricted to a maximum of 15,000 ft2 or 0.344 Acres (EPA Reg. No. 100-468), and was used for granular formulation scenarios only.

Application Rates

	Minimum	Typical	Maximum
lb a. i./Acre	0.25	1	4
lb a. i./Gallon	0.20	2	5

Table 10(c). Residential Handler Turf Scenarios ***(Short-Term Only)*** [Based on MRID No. 449591-01, and 0.3444 Acres (=15,000 ft^2)]							
Formulation	Application Rate [1]	Unit Exposure [2] (mg/lb ai)		Dose [3] (mg/kg/day)		MOE [4]	
		dermal	inhalation	dermal	inhalation	dermal	inhalation
Liquid (Low Pressure Hand Wand)	4 lbs. ai/A	100	0.03	2.0	0.00059	0.12	44
Liquid (Garden Hose End Sprayer)	4 lbs. ai/A	30	0.0095	0.59	0.00019	0.42	140
Granular [Push-type Spreader (Head& neck data is not available)]	4 .4 lbs. ai/A	3.0	0.0063	0.065	0.00014	3.9	190
Granular (Belly-Grinder)	4 .4 lbs. ai/A	110	0.062	2.4	0.0013	0.10	20

[1] =Application rate is based on the Registrant Study, MRID #449591-01, and the labels, Ortho® Diazinon Ultra™ (EPA Reg # 239-2643, Liquid water base concentrate, 22.4% ai, application rate = 4 lbs. ai/A), Ortho® Diazinon Soil and Turf ™ (EPA Reg # 239-2479, granular, 4,84 % ai, application rate = 4.4 lbs. ai/A).

[2] =Unit Exposure (UE, mg/ lbs. ai handled) is based on short pants, short sleeve shirt, no gloves nor respirator; from SOPs Residential Exposure Assessments Guide (August 1997).

[3] = Dose = for dermal,{[UE x (Application rate/Acre) x 0.344 Acres]/ Body Weight- 70kg} x 1 (100 % dermal absorption). for inhalation,{[UE x (Application rate/Acre) x 0.344 Acres]/ Body Weight- 70kg}. The plot areas treated within this study ranged from 1196 ft^2 to 1472 ft^2 . The area treated in these scenarios, that a resident could treat in a day were assumed to be 15,000 ft^2 (= 0.3444 Acre), based on the granular label - EPA Reg. No. 100-468.

[4] = Dermal Short-term end point, NOAEL = 0.25 mg/kg/day, MOE = 0.25 mg/kg/day/ Dose (mg/kg/day)
Inhalation, all time periods end point, LOAEL = 0.026 mg/kg/day, MOE = 0.026 mg/kg/day/ Dose (mg/kg/day)

For dermal, MOEs greater than 100, do not exceed HED's level of concern.
For inhalation, MOEs greater than 300, do not exceed HED's level of concern.

(iii). Post-application Exposures and Risk Estimates

All residential uses of diazinon provide opportunities for short-term, dermal post-application exposures. Lawn and carpet treatments provide opportunities for short-term post-application exposures to adults and children in the home. Several studies were submitted by the registrant for non-occupational (residential) post-application exposures. Only two of these studies had chemical specific data of sufficient quality to use in risk assessments; they are: MRID Nos. 443488-01, and 449591-01. Adult and toddler exposures were assessed. Toddlers are the subgroup with the highest potential exposures. Their short-term exposures are expected to occur through direct dermal exposures associated with crawling, and oral exposures through hand-to-mouth activities.

Tables 11(a), 11(b), 12(c), and 13 provide risk estimates for adults and toddlers potentially exposed to diazinon after crack & crevice indoor treatments to hard surfaces and carpet; and outdoor lawn treatments. All of the estimated risks are presented in detail below for adults and toddlers.

Turf Study MRID # 449591-01

This study was conducted in response to an EPA Special Data Call In Notice (March 3, 1995, and February 1998 amendment) for Residential Re-Entry Exposure (received November 08, 1999). Novartis conducted a diazinon Turf Transferable Residue (TTR) and Dissipation study in three different states; which are Georgia, California, and Pennsylvania. This study was also conducted in accordance with EPA, FIFRA Good Laboratory Practice Standards (GLP) 40 CFR Part 160 (October, 1989), and was designed to meet all the requirements of the Agency's Pesticide Assessment Guidelines, Subdivision K, Exposure, Series 132-1 (a) (Series 875-Occupational and Residential Exposure Test Guidelines, 875.2100). The test protocol template was developed by the Outdoor Residential Exposure Task Force (ORETF) for use by Task Force member companies when conducting turf transferable residue studies. The turf transferable method used in this study is called the Modified California Roller Method, which was selected by the ORETF. The two primary formulations of diazinon that are used in the residential market are the granular and the liquid. The Water-Based Concentrate (WBC) was developed to reduce the odor associated with the solvent-based emulsifiable concentrate, which is being phased out of the market place [see Table 11(a), for details].

The quality of the data was good for the turf transferable residues, and the ambient airborne samples. However, the ambient airborne samples should of been obtained from high volume pumps that can be set to simulate the breathing rate of the toddler and the adult (approximately 6 liters/minute and 10 liters/minute respectively).

Sampling of the air above the treated plots were conducted for 8 hours after application in order to assess inhalation as a possible route of re-entry exposure [see Table 11(b), for details].

Post-application Turf Exposure Scenarios

Liquid-formulated- **both, adult (MOE=43) and toddler(MOE=26) calculated dermal exposure scenarios exceed HED's level of concern, except** for two toddler non-dietary exposure scenarios; which are:1) Hand to mouth ingestion (MOE=680); and 2) Toddler Ingestion of Diazinon-Treated Turf-grass (MOE=6800).

Liquid-formulated post-application calculated **inhalation** exposure scenarios for the overall average airborne levels from all three location sites (GA, CA, & PA), are as follows:

Adult

At 10 liters/min (= 14.4 m^3/day, which is slightly less than the default adult ventilation rate of 15.2 m^3/day), MOE =300; at 15 liters/min (=21.6 m^3/day), MOE=200; and at 29 liters/min (= 41.8 m^3/day), MOE=100. The calculated MOE is at or above 300 for the adult at 10 liters/min (= 14.4 m^3/day) which is approximately the same as the default ventilation rate of 15 m^3/day ; therefore this **post-application inhalation exposure does not exceed HED's level of concern.**

Toddler

At 6.04 liters/min (= 8.7 m^3 /day, the default toddler ventilation rate), MOE =110; **this calculated MOE is below 300, and exceeds HED's level of concern.**

All granular-formulated post-application calculated dermal exposure scenarios **do not exceed HED's level of concern** (all MOEs are greater than 210), nor does the Toddler Non-dietary Ingestion scenarios (Hand-to-mouth & treated grass ingestion), or the Toddler Ingestion from granules scenario of Diazinon treated areas (all three MOEs are greater than 420).

All granular-formulated post-application calculated inhalation exposure scenarios **do not exceed HED's level of concern** (all MOEs are greater than 700.

Combined post-application risk estimates from the turf granular formulation, are as follows:

Toddler

For the short-term dermal and acute non-dietary exposures/doses, a NOAEL of 0.25 mg/kg/day is used; therefore these combined risk estimates are equal to: short-term dermal dose + non-dietary dose (from hand-to-mouth and granule ingestion) = 0.00124597 mg/kg/day, **MOE = 0.25 mg/kg/day/0.00124597 mg/kg/day = 200**

For the inhalation exposure/dose, at 6.04 liters/min (= 8.7 m^3 /day), a LOAEL of 0.26 mg/kg/day is used, this calculated risk estimate **MOE is equal to 0.026 mg/kg/day/0.000021mg/kg/day = 1200**

Total combined toddler exposure risk estimates are from dermal, non-dietary, and inhalation:

$ARI = MOE_{calculated} / MOE_{acceptable}$

$ARI_{dermal+ \text{ non-dietary (hand-to-mouth+ingestion of granules)}} = MOE_{calculated \text{ dermal+ non-dietary}} / MOE_{acceptable \text{ dermal+ non-dietary}}$

$ARI_{inhalation} = MOE_{calculated \text{ inhalation}} / MOE_{acceptable \text{ inhalation}}$

$$Aggregate Risk Index (ARI) = \frac{1}{\frac{1}{ARI_{derm + non - dietary}} + \frac{1}{ARI_{inhalation}}}$$

An ARI equal to one or greater, does not exceed HED's level of concern.
The calculated ARI is equal to 1.3, which dose not exceed HED's level of concern.

Adult

For the short-term dermal exposure/dose, a NOAEL of 0.25 mg/kg/day is used; therefore this risk estimate is equal to: short-term dermal dose = 0.00124597 mg/kg/day, **MOE = 0.25 mg/kg/day/0.0007 mg/kg/day = 360**

For the inhalation exposure/dose, at 10 liters/min (= 14.4 m^3/day) , a LOAEL of 0.26 mg/kg/day is used, this calculated risk estimate **MOE is equal to 0.026 mg/kg/day/0.0000077mg/kg/day = 3400**

Total combined adult exposure risk estimates are from dermal, and inhalation:

$ARI = MOE_{calculated} / MOE_{acceptable}$
$ARI_{dermal} = MOE_{calculated\ dermal} / MOE_{acceptable\ dermal}$
$ARI_{inhalation} = MOE_{calculated\ inhalation} / MOE_{acceptable\ inhalation}$

The calculated adult ARI is equal to 2.7, which dose not exceed HED's level of concern.

Turf Study MRID # 402029-01: **was only used for supplemental information** to the more recent Turf Study (MRID # 449591-01) submitted by Novartis in December of 1999, because this study had to many data discrepancies. Some examples, are: the number of geographical locations were not identified; the analytical method validation (the limit of detection or the limit of quantification was not provided), field fortification data, storage stability, etc., and the time when pesticide residues were dislodged from grass clippings was not provided (the recommended time for sample analysis should be done within 4 hours from the time of its collection).

Turf Study MRID # 420633-01: **was only used for supplemental information** to the more recent Turf Study (MRID # 449591-01) submitted by Novartis in December of 1999, because this study also had to many data discrepancies. Some examples, are: the number of geographical locations should of been for three different locations, instead of having one geographical area, which was done in this study (Madera county, California), the analytical detection limit was only set at 10 μg/sample, which should of been set at least at 5 μg/sample, as in the above turf study, MRID # 449591-01; the application rate (of 4 lbs.ai/A) used in this study is lower than the most recent turf study, which was 4.4 lbs. ai/A; little or no information was provided regarding the physical/chemical differences between the formulations (Dyfonate 5-G/Diazinon 5-G), and no discussion was included concerning the environmental fate data for each pesticide (fonofos and diazinon); and this study did not use the Modified California Roller Method, which was selected by the ORETF. In the Modified California Roller Method the weight of the roller is critical to the amount of residues captured, the heavier the roller- the higher the residue amount. The Modified California Roller Method requires a roller weight of 32 pounds, +/- 1 pound in variation. This study utilized a roller weighing 60 kilograms (132 pounds), which means one would expect turf transferable residues (TTR) to be much higher in this study. Higher TTRs were seen/observed in this study.

Table 11(a). Diazinon Turf Transferable (TTR) Residues Available- Non-irrigated, Dose, and MOEs (*MRID #449591-01*)									
Location	**Formul'n**	**Time [1] Interval**	**Residue [2] Average (μg / cm^2)**	**Dose [3]**			**Short-term MOE [4]**		
				Adult	**Child**	**Child[a]**	**Adult**	**Child**	**Child[a]**
GA	**Liquid**	**Post-App**	**0.0053**	**0.0022**	**0.0037**	**0.00014**	**110**	**68**	**1800**
	Granular	**Post-App**	**0.0019**	**0.00079**	**0.0013**	**0.000051**	**320**	**190**	**4900**
CA	**Liquid**	**Post-App**	**0.022**	**0.0091**	**0.015**	**0.00059**	**28**	**17**	**420**
	Granular	**4-Hours**	**0.0015**	**0.00062**	**0.0010**	**0.00004**	**400**	**250**	**6200**
PA	**Liquid**	**Post-App**	**0.016**	**0.0066**	**0.011**	**0.00043**	**38**	**23**	**580**
	Granular	**4-Hours**	**0.0018**	**0.00075**	**0.0012**	**0.000048**	**330**	**210**	**5200**
Liquid Average	**Liquid (All three Sites)**	**Post-App**	**0.014**	**0.0058**	**0.0097**	**0.00037**	**43**	**26**	**680**
Granular Average	**Granular (All three Sites)**	**Post-App**	**0.0017**	**0.00070**	**0.0012**	**0.000045**	**360**	**210**	**5600**

[1] = Application rate is based on the Registrant Study, MRID #449591-01, and the labels, Ortho® Diazinon Ultra™ (EPA Reg # 239-2643, Liquid water base concentrate, 22.4% ai, application rate = 4 lbs. ai/A), Ortho® Diazinon Soil and Turf ™ (EPA Reg # 239-2479, Granular, 4.84 % ai, application rate = 4.4 lbs. ai/A). Samples were taken from the plots during three sampling time intervals on the day of application (DAT-0) ; they were: Post-app, 4 hours, and then 8 hours.

[2] = Residue data is based on a diazinon chemical specific Registrant's (Novartis) Study (MRID #449591-01). The highest amount of residues were taken from the day of application (DAT-0), which appears to be within 1-4 hours after application, depending on the formulation.

[3] = The highest percentage of residues available from turf, of an application rate of 4 lbs. ai /A, treated with liquid formulated diazinon spray, was 0.05 % (California). Exposure Dose is based on: Short pants, short sleeve shirt, no gloves, Child Body Weight (BW)= 15 kg; Adult BW = 70kg, and 100 % dermal absorption. Turf Transfer Coefficients (Tc), for the Adult = 14,500 and for the Child = 5,200 cm^2 /hr, and the exposure duration is 2 hours. **Dermal Dose** = [TTR x Tc x (0.001 mg/μg) x 2 hours] / BW

[4] = Dermal Short-term end point and Acute Dietary end point, NOAEL = 0.25 mg/kg/day
MOE = 0.25 mg/kg/day/ Dose (mg/kg/day). **Dermal MOEs greater than 100,do not exceed HED's level of concern.**

[a] = For **Non-dietary Hand to Mouth exposure**, 20 events per hour x 20 cm^2 per event (20cm^2 is based on child's palmer surface area of 3 fingers) and 50% extraction by saliva. Hand to Mouth Dose =[TTR x surface area x events/hr x (0.001 mg/μg) x 2 hours x 0.5] / BW

Toddler Ingestion of Liquid Diazinon-Treated Turf-grass:
Highest Fraction (**F**) of ai available on the grass, is from California, 0.049% from 4 lbs ai/A,
GR= grass (and plant matter) residue on day 0 (μg/cm^2); GR = Appl.Rate x F x (4.54 X10^8 μ/lb) x (2.47 X 10^{-8} A/cm^2) = (4 lbs ai/A) x (0.00049) x (4.54 X10^8 μ/lb) x (2.47 X 10^{-8} A/cm^2) = **0.022 (μg/cm^2); Dose** = [GR x 25 cm^2/day (default-based

on toddler ingestion rate per day) x (0.001 mg/μg)]/15kg = 0.000037 mg/kg/day;
MOE =0.25/0.000037=6800

Toddler Ingestion from Granules From Diazinon Treated Areas:
Dose = [0.3 g /day x 0.0484 (% ai) x (0.001 g/mg)]/15kg = 0.00000097 mg/kg/day;
MOE =0.25/0.00000097= 260,000

This information [defaults (e.g. Tc, events/hr, surface area, etc.)] above is from the Revised SOPs Residential Exposure Assessments Guide (NOV. 1999).

Table 11(b). Diazinon Post-application (0-2 hrs After Application) Toddler Airborne Levels ***(Data From the Registrant's Study MRID # 449591-01)***

Location	Airborne Levels [1,2] (μg/sample) @ 1.5 liters/min		8-hr Airborne Levels [1,2] (mg/ day) @ 6 liters/min		Dose [3]		MOE [4]	
	L	G	L	G	L	G	L	G
GA	0.20	0.05	0.00080	0.00020	0.000053	0.000013	490	2000
CA	1.5	0.05	0.0060	0.00020	0.0004	0.000013	65	2000
PA	0.99	0.14	0.0040	0.00056	0.00027	0.000037	96	700
Over-all Average	0.90	0.08	0.0036	0.00032	0.00024	0.000021	110	1200

Note: L = Liquid; G = Granular Formulations

[1] = Application rate (4 lbs. ai /A) is based on the Registrant Study, MRID #449591-01, and the labels, Ortho® Diazinon Ultra™ (EPA Reg # 239-2643, Liquid water base concentrate, 22.4% ai, application rate = 4 lbs. ai/A), Ortho® Diazinon Soil and Turf ™ (EPA Reg # 239-2479, Granular, 4.84 % ai, application rate = 4.4 lbs. ai/A).

[2] = Airborne concentration level data is based on a diazinon chemical specific Registrant's (Novartis) Study (MRID #449591-01). The highest non-irrigated, airborne level samples were taken from the plots within each location during 0-2 hours after application (@ 1.5 liters/min). The liquid formulations had the highest airborne levels. Airborne levels (mg/day) = [μg/sample (is for 2-hrs) x 4 (adjusting up to the default, Toddler ventilation rate of 8.7 m ^{3}/day for 24 hours or 6.04 liters/min) x (0.001mg/ μg)]= mg/day. The Registrant only took samples for only 8-hrs within the study on the day of application (DAT-0). These airborne levels in the table above are the worst case scenario.

[3] = The highest percentage of airborne levels, of an application rate of 4 lbs. ai /A, for turf treated with liquid formulated diazinon spray, were for California. Exposure Dose is based on: Short pants, short sleeve shirt, no gloves, and no respirator. Child Body Weight (BW)= 15 kg; Adult BW = 70kg.. An example of Dose calculations, the post-application liquid formulation average airborne level results for toddlers were 0.0036 mg/day, **Toddler Inhalation Dose** = 0.0036 mg/day / 15 kg =0.00024 mg/kg/day.

[4] = Inhalation end point for all time periods, LOAEL = 0.026 mg/kg/day. MOE = 0.026 mg/kg/day/ Dose (mg/kg/day).
Toddler MOE *= 0.026 mg/kg/day /0.00024 mg/kg/day = 110.*

MOEs greater than 300, do not exceed HED's level of concern.

NOTE: To estimate an adult's inhalation exposure could be like, I also took the same exposure utilized for the toddler, re-adjusted the ventilation rate to reflect an adult's post-application inhalation exposure. The default adult ventilation rate (15.2 m ^{3}/day) is slightly more than 10 liters/min (=14.4 m^3/day). Adult calculated turf post-application inhalation exposures/doses were conducted for both formulations (the average from all three sites of the granular & liquid), at three ventilation rates for the liquid and two for the granular formulation, which are: @ 10 liters/min, @ 15 liters/min, and @ 29 liters/min. For the adult, @ 10 liters/min, exposure =0.090 μg/sample X 6.7 (adjusting up to 10 liters/min) X 0.001 mg/μg = 0.00603 mg /day. Dose = 0.0063mg/day / 70kg = 0.000086 mg/kg/day. MOE = 0.026mg/kg/day/0.000086mg/kg/day = **300** (for the granular formulation-Dose= 0.0000077mg/kg/day, MOE=3400). For the adult, @ 15 liters/min, exposure = 0.009 mg/day, Dose =

0.00013 mg/kg/day, and **MOE = 200.** For the adult, @ 29 liters/min, exposure = 0.0174 mg/day, Dose = 0.00025 mg/kg/day, and **MOE = 100** (for the granular formulation-Dose= 0.000021mg/kg/day, MOE=1200).

MRID Nos. 443488-01, and -06

MRID #443488-01

This report reviews exposure assessments submitted by Novartis Crop Protection, Inc. (formerly Ciba Crop Protection, Ciba-Geigy Corporation) to US-EPA. Novartis assesses applicator exposure and residential post application exposure resulting from the indoor uses of the organophosphate insecticide diazinon. The Novartis report **does not contain raw data, rather it presents exposure calculations based on other studies**, only some of which have been published in the open literature.

The author begins by reviewing a list of eleven diazinon products registered to Novartis for use in and around residences and offices, containing from 0.5% to 56% a.i. diazinon. Of the eleven products listed, only one seems to have been used in the studies on which the assessments rely. This product was D-z-n® Diazinon 4E, which is an emulsifiable concentrate (i.e. 4 lb a.i./gallon, or 47.5% a.i.). Next, the author reviews various use pattern data from California Department of Pesticide Regulation (CDPR, 1993), EPA's National Home & Garden Pesticide Use Survey (NHGPUS, 1992), and a report on professional lawn care pesticide usage ("Professional Markets for Pesticides and Fertilizers, the "Kline Report," 1993).

Relevant findings included:

CDPR reported that PCOs applied diazinon most frequently for structural pest control (22,473 applications that year), handling an average of 12.9 lbs a.i./application;

> EPA's one-time survey of homeowner pesticide usage found that diazinon was most frequently applied outdoors by the general public. About 15% of households reported using diazinon. Of those, approximately 23% of all applications were made indoors, most commonly to the kitchen.

The author estimates occupational exposure using data from two sources: (1) the Pesticide Handlers Exposure Database (PHED), version 1.1; and (2) a urine bio-monitoring study (Hayes et al., 1980) in which several pesticides were applied. Post-application inhalation exposures for adult and toddler residents were estimated using three indoor air studies, the model SCIES, and EPA's Non-occupational Pesticide Exposure Study (NOPES, 1993). Amounts of diazinon applied were much lower in the three indoor air monitoring studies (between 1.8 and 11.3 grams ai applied) than postulated for the occupational exposure assessment (i.e. 12.9 pounds ai applied).

> PCO dose to diazinon estimated using PHED was 25 μg/kg/day, utilizing adermal absorption of 3.3 % (at 100% dermal absorption, PCO dermal dose = 0.52 mg/kg/day) . The author estimated PCO absorbed dose from the urine biological monitoring study was 2.2 μg/kg/day. This absorbed daily dose however, is actually a result of exposure to both diazinon and chlorpyrifos. Because the major metabolites of chlorpyrifos (i.e. DEP and DEPT) are the same as those from diazinon, the author chose to assume conservatively that all residues found in urine derived only from diazinon. **The Agency does not concur**

that all residues found in urine are from both chlorpyrifos and diazinon, because the metabolites that were indicated by the author for diazinon are not the same for chlorpyrifos.

Measured and modeled peak indoor air concentrations were all similar, ranging from 4.65 to 87 $\mu g/m^3$.

Based on the average indoor air level found in three air monitoring studies over the first 24 hours after application, daily adult inhalation exposure on the first day after application was estimated to be 8.2 $\mu g/kg/day$. Daily toddler inhalation exposure on the first day after application was estimated to be 21.9 $\mu g/kg/day$.

Based on the average indoor air (personal samples) level found in Florida (e.g. high-use location, seasonal peak), daily adult inhalation exposure on the first day after application was estimated to be 0.069 $\mu g/kg/day$. Daily toddler inhalation exposure on the first day after application was estimated to be 0.19 $\mu g/kg/day$. [The average value used ranked at the 75^{th} percentile among measurements made.]

Overall, the rationale used to present the inhalation (dermal exposure was not monitored nor assessed) exposures for both the Applicator and for Post Application was reasonable. The following issues and concerns were identified, however:

The reviewers note that the exposure estimates presented may not be directly comparable since different (or unknown) quantities of diazinon may have been applied. PHED estimates are based on 12.9 pounds ai/day applied. Two Novartis indoor air monitoring studies applied 11.3 and 10 grams ai/day (the SCIES modeling run assumed 11.3 grams ai/day applied). A third indoor air study applied only 1.9 grams ai/day. Amounts applied in the NOPES and the Hayes (bio-monitoring) studies were not reported.

The quality of the data reported from the three indoor air monitoring studies is not known. The reviewers could not determine whether the studies complied with OPPTS 875 guidelines. For most of the studies, it is unknown whether, for example, raw data were corrected for field fortified or laboratory recoveries.

Several typographical errors were noted. PHED estimated exposures were variously reported as 23 or 25 $\mu g/kg/day$. Peak post-application indoor air values are variously reported as 54 $\mu g/m^3$ or 60 $\mu g/m^3$. Daily inhalation exposure to adults and toddlers were reported as 8.9 $\mu g/kg/day$ and 24 $\mu g/kg/day$, respectively, however, on page 33 of the Study Report, these exposure values were reported as 8.2 $\mu g/kg/day$ for adults and 21.9 $\mu g/kg/day$ for toddlers.

Previously, in 1996, the Agency granted a waiver for indoor residential dermal post-application exposure data. <u>However, in light of FQPA, the data waiver previously granted for indoor residential dermal post-application exposure data is no longer applicable</u>. The registrant needs to provide **quality** chemical specific (diazinon) indoor residential dermal and inhalation

post-application exposure study data (per Series 875.2400); in order to refine post-application exposure estimates. Table 12, below, summarizes the exposure estimates presented by the author.

Table 12(a) - Summary of Novartis Diazinon Indoor Exposure Assessment Information

Source	Indoor PCO - Absorbed Dose	Post-Application, Indoor Inhalation Exposure		
		Peak Air Conc'n	Adult	Toddler
PHED, v. 1.1 (37 surrogate data points) Assumed 12.9 lbs ai/day applied	25 μg/kg/day	NA	NA	NA
Hayes et al. (1980) Biological Monitoring over 3 months of PCOs (N=14) applying 2% diazinon dust (amount unkn)	2.2 μg/kg/day (total dose) and 0.74 μg/kg/day (inhalation only; based on mean)	41 μg/m^3 (3.8 μg/m^3 was the geometric mean)	NA	NA
Novartis, 1980 Indoor air monitoring after whole house crack & crevice treatment - 11.3 grams ai	NA	55 μg/m^3	8.2 μg/kg/day[1] (All 3 studies' Avg.)	21.9 μg/kg/day[1] (All 3 studies' Avg.)
Novartis, 1981 Indoor air monitoring after whole house crack & crevice treatment - 10 grams ai	NA	87 μg/m^3 (during appl'n)	see Novartis 1980, for all 3 studies' average	see Novartis 1980, for all 3 studies' average
North Carolina State University, Wright & Leidy, 1982 Indoor air monitoring after dorm room application - 1.9 grams ai	NA	38 μg/m^3	see Novartis 1980, for all 3 studies' average	see Novartis 1980, for all 3 studies' average
SCIES Model Indoor air monitoring after kitchen crack & crevice treatment - 11.3 grams ai assumed	NA	18 μg/m^3	---	—
NOPES Survey Jacksonville, FL - summer Ambient Air samples	NA	13.7 μg/m^3 (0.42 μg/m^3 was the arithmetic mean)	---	---
NOPES Survey Jacksonville, FL - summer Personal Samples	NA	4.65 μg/m^3 (0.32 μg/m^3 was the arithmetic mean)	0.069 μg/kg/day (NOPES only; based on mean)	0.19 μg/kg/day (NOPES only; based on mean)

1. "Maximum inhalation exposure" is based on an average indoor air concentration of 37.8 $\mu g/m^3$ over the first 24 hours after diazinon application (three studies; N=6 data points at time=0 and time = 24 hours, two data points from each study); inhalation rate of 15.2 m^3/day for an adult, and 8.7 m^3/day for a toddler; body weights 70 kg for an adult and 15 kg for a toddler.

Post Application Indoor Air Concentration Study Conclusions

The peak or maximum air levels of diazinon monitored in the Novartis and North Carolina State University studies and predicted by SCIES were similar. Table 12(b), below, provides a comparison between the three studies and the SCIES predicted values. The average post application air concentrations of diazinon predicted by SCIES are much lower than measured concentrations in the Novartis and North Carolina State University diazinon studies. The SCIES model is expected to predict a lower average concentration than the actual measured concentrations. The SCIES model is based on diazinon application only in the kitchen rather than in the entire house, as in the Novartis study or one small enclosed room as in the North Carolina State University study. The SCIES model also assumes that the homeowner was out of the house for three hours during the day.

Table 12(b). Comparison of Diazinon Indoor Air Monitoring Study Results and Modeling Results

Parameters	1980 Novartis Study	1981 Novartis Study	North Carolina State University Study	Studies Averaged	SCIES (predicted)
Maximum Air Concentrations	55 $\mu g/m^3$	69 $\mu g/m^3$	38 $\mu g/m^3$	54 $\mu g/m^3$	18 $\mu g/m^3$
Average Post Application Air Concentrations	24 $\mu g/m^3$ (24 hours)	11 $\mu g/m^3$ (24 hours)	30 $\mu g/m^3$ (24 hours)	22 $\mu g/m^3$	0.20 $\mu g/m^3$ (day of application)
Application Zone (size of room)	Entire house (size not provided)	Entire house (size not provided)	Small room (Dorm-45.1 m^3)	N/A	Kitchen only (20.0 m^3)

Note: SCIES considers an entire house's volume = 408 m^3

The NOPES data provides a profile of general population exposure to diazinon indoor air levels. The NOPES data indicates the impact of diazinon use levels on indoor air concentrations. Air concentrations in both cities dropped markedly during the winter when insecticide use was minimal. In geographical areas such as Springfield, MA, where insect infestation is not a major problem, the air concentrations of diazinon are very low, below the limit of detection at the 75th percentile of the population. The mean indoor air concentration in the spring within Springfield, MA was 0.048 $\mu g/m^3$ (at or greater than the 95 percentile) compared to the Jacksonville mean indoor air concentration in the summer (**season of highest diazinon use** within Jacksonville) of 0.42 $\mu g/m^3$ (between the 75 and the 90 percentiles; at the 95 percentile- airborne level concentrations are equal to 2.2 $\mu g/m^3$). The Jacksonville NOPES data are reflective of indoor air concentrations in homes where insect problems are great and where diazinon is used for insect control, **except** in northern areas during the winter months (e.g. Chicago and New York project

areas). It is highly probable that in geographical northern areas during the winter months that residents would tend to keep windows and doors closed due to the environmental temperatures and high crime rates in these areas. Therefore it is expected that inhalation exposure values for high infested areas, where diazinon is used for insect control in the North during the winter months would be higher than the reported Jacksonville inhalation exposure levels. During the monitoring period of highest concentration (summer) the average air concentration measured on the personal air samplers was 0.32 $\mu g/m^3$- slightly above the 75th percentile, and 1.9 $\mu g/m^3$ at the 95th percentile (in Jacksonville). The SCIES model predicted the average air concentration for a homeowner to be 0.12 $\mu g/m^3$. NOPES Jacksonville air concentrations measured with the personal air samplers account for individual activity patterns as does the SCIES model. The maximum diazinon air concentration monitored in the NOPES study was 13.7 $\mu g/m^3$ which is almost identical to the SCIES predicted peak air concentrations of 18 $\mu g/m^3$ and ranges from 20% to 36% of the maximum post application air concentrations of 38, 55, and 69 $\mu g/m^3$ measured in the Novartis and air monitoring studies.

Estimation of Post Application Diazinon Indoor Inhalation Exposure

Table 12(c), below, presents the daily indoor inhalation exposure results calculated using the results from the monitoring studies. According to these monitoring studies, the greatest potential for post application inhalation exposure to diazinon occurs during the 24 hours following the indoor application of diazinon. Based on the monitoring data from the three studies, at time 0 and 24 hours, an average indoor air concentration of 37.8 $\mu g/m^3$ {[(0.55+0.024-Novartis-1980) +(0.069 +0.011-Novartis-1981) + (0.038 +0.030 -North Carolina State Univ.)] / 6 = 37.8 $\mu g/m^3$} was used as the indoor air concentration of diazinon during the first 24 hours after indoor application. The Agency default daily inhalation volume of 15.2 m^3/day for an adult was used to estimate the daily inhaled dose. Based on 100% absorption and a 70 kg body weight, the daily inhaled dose of diazinon during the 24 hours following indoor application was calculated. The equations used were provided on page 33 of the Study Report. The daily adult inhalation exposure-first 24 hours post application was 8.2 $\mu g/kg/day$. The daily toddler inhalation exposure-first 24 hours post application using 15 kg for body weight and 8.7 m^3/day inhalation volume (Agency default) was calculated to be 21.9 $\mu g/kg/day$.

Using the NOPES Jacksonville summertime **average** indoor air concentration of 0.32 $\mu g/m^3$ (95th percentile = 1.9 $\mu g/m^3$) , which represents a reasonable upper-bound estimate for this geographical area of diazinon air concentration after the initial application. The daily adult inhalation exposure was calculated to be 0.069 $\mu g/kg/day$ and the daily toddler inhalation exposure was calculated to be 0.19 $\mu g/kg/day$.

Table 12(c). Post Application Diazinon Indoor House Inhalation Exposures		
Exposure Calculations	**Dose Daily Results mg/kg/day**	**MOEs[1]**
From 3-studies above, Daily Adult- First Day (24-hours) After Application	0.0082	3.2
From 3-studies above, Daily Toddler -First Day (24-hours) After Application	0.022	1.2
NOPES -Daily Adult Inhalation Exposure (for the mean and the 95th percentile)	Mean- 0.000069	380
	95th - 0.00041	63
NOPES -Daily Toddler Inhalation Exposure (for the mean and the 95th percentile)	Mean- 0.00019	140
	95th - 0.001	26

[1] = Margin Of Exposure (MOE) = Inhalation (for all time frequencies) LOAEL (0.026 mg/kg/day)/Daily Inhalation Dose. *The **Inhalation Target MOE = 300; which does not exceed HED's level of concern.***

The registrant did not address dermal exposure during this study; Data from several sources were examined to complete dermal exposure risk assessments. The data for dermal exposures were obtained from the following sources: the inhalation exposure data (lbs/gms ai applied) in this registrant's study, the current registrant's label- 4E's application rate, current real-estate information (e.g. room sizes within houses, built around 1961 to 1999), and other information (e.g. Tc, events/hr, surface area, etc.) from the Revised SOPs Residential Exposure Assessments Guide (NOV. 1999). Table 13, below, summarizes the dermal exposure, dose, MOE estimates presented by the Agency (Reviewer).

Table 13. - Summary of Diazinon Indoor Post-application Short-Term Dermal Exposure Assessment Information (Based on Novartis's post-application inhalation data)

Source (4E-Label) [1]	Application Rate		Area ($ft.^2$) [2]	Indoor Surface Residue ($\mu g/cm^2$) [3]	Dose [4]		MOE [5]	
	Lbs.	gms.			Adult	Toddler	Adult	Toddler
EPA Reg# 100-463 @ 1%, 1.3 liters [a]	0.026	11.8	Kitchen 40.5 [a]	15.7 (hard surfaces)	15	25	0.017	0.01
EPA Reg# 100-463 @ 1%, 1.3 liters [b]	0.026	11.8	Kitchen 40.5 [a]	15.7 [a] (I0% skin contact of hard surfaces)	1.5	2.5	0.17	0.1
EPA Reg# 100-463 @ 0.5%, 1.3 liters [c]	0.013	5.9	Kitchen 40.5 [a]	7.8 (hard surfaces)	7.5	12	0.033	0.021
EPA Reg# 100-463 @ 0.5%, 1.3 liters [d]	0.013	5.9	Kitchen 40.5 [a]	7.8 [a] (I0% skin contact of hard surfaces)	0.75	1.2	0.33	0.2
EPA Reg# 100-463 @ 0.5%, 1-gal [e]	0.039	17.7	House 189 [b]	2.6 (carpet surfaces)	5	8.3	0.05	0.03
EPA Reg# 100-463 @ 0.5%, 1-gal [f]	0.039	17.7	House 189 [b]	2.6 [a] (25% skin contact of carpet surfaces)	1.2	2.1	0.21	0.12
EPA Reg# 100-463 @ 0.25%, 1-gal [g]	0.02	8.9	House 189 [b]	1.3 (carpet surfaces)	2.5	4.2	0.1	0.06
EPA Reg# 100-463 @ 0.25%, 1-gal [h]	0.02	8.9	House 189 [b]	1.3 [a] (25% skin contact of carpet surfaces)	0.62	1	0.40	0.25

[1] = This label was used in the registrant's Study, MRID 443488-01.

[a] = This concentration, and amount was approximately used in this study. The predominant area that was treated was in the kitchen (hard surfaces), and air sampling pumps were placed in the kitchen to collect the inhalation exposure data; therefore this dermal exposure/dose corresponds to the inhalation exposure recorded within this study report [see table 12 (a), above (Novartis-1980) for the corresponding average inhalation exposure from three studies (Novartis-1980, Novartis-1981, & North Carolina State University), and table 12(c), for their corresponding dose and MOE].

[b] = The same information in foot note [a] above applies, except for assuming only 10 % dermal contact of hard surfaces with residents.

[c] = The same information in foot note [a] above applies, except for the concentration; which has been reduced by half to 0.5%.

[d] = The same information in foot note [a] above applies, except for assuming only 10 % dermal contact of hard surfaces with residents and the concentration; which has been reduced by half to 0.5%.

[e] = This concentration and amount is typical for minor to moderate infestations of insects for an entire house's main living areas, see footnote 2[b], for details of which areas.

[f] = This concentration and amount is typical for minor to moderate infestations of insects for an entire house's main living areas (see footnote 2[b], for details of which areas), except for assuming only 25 % dermal contact of carpet surfaces.

[g] = This concentration and amount is typical for minor (pest free maintenance) infestations of insects for an entire house's carpeted main living areas (see footnote 2[b], for details of which areas).

[h] = This concentration and amount is typical for minor (pest free maintenance) infestations of insects for an entire house's carpeted main living areas (see footnote 2[b], for details of which areas), except for assuming only 25 % dermal contact of treated carpet surfaces.

[2] = The registrant's study, MRID # 443488-01, did not provide the square footage that was treated by the PCO in both North Carolina studies of 1980 & 1981; nor the area of the kitchens or houses where these studies took place.

[a] = For Crack & Crevice application, the average square footage was obtained from real estate data of 6-7 houses, built in 1961 - 1999 and the treated base-board's footage. First, the average estimated potential treated perimeter was determined, for the kitchen; which is: Kitchen = 54 ft. [(14 x 2) + (13 X 2)]. And two, the estimated potential treated base-board footage was determined by assuming the base-board's height is 3.5 inches tall, 2 inches above it and then 3.5 inches out from the wall = 9 inches in all = 0.75ft. The total area treated of the kitchen was determined by taking the total linear feet by the estimated potential treated base-board's footage = 40.5 ft^2 .

[b] = For Crack & Crevice application, the average square footage was obtained from real estate data of 6-7 houses, built in 1961 - 1999 and the treated base-board's footage. First, the average estimated potential treated perimeters were determined, and are as follows: Living Rm. = 60 ft. [(17 x 2) + (13 X 2)]; Dining Rm. = 44 ft. [(12 x 2) + (10 X 2)]; Master Bed Rm. = 54 ft. [(15 x 2) + (12 X 2)]; Bed Rm.-2 = 48 ft. [(13 x 2) + (11 X 2)]; and Bed Rm.-3 = 46 ft. [(13 x 2) + (10 X 2)] = total linear feet of 252. And two, the treated base-board footage was determined by the same method as in foot note 2[a]. The treated total area of the house was determined by taking the total linear feet by the estimated potential treated base-board's footage =

189 ft^2 .

Only the carpeted main living areas were considered; such as bed rooms, living rooms, and dining rooms, as a screening level to estimate what dermal exposures/does could be. Hallways, closets, basements, and utility areas were not considered at this time.

[3] = Indoor Surface Residue (ISR-$\mu g/cm^2$) = [(lbs. ai / square footage area treated) X (50% of potential maximum ai concentration available from crack & crevice treatment) X (% of Indoor surface transferable residues- 5% for carpets, and - 10% for hard surfaces) X (Conversion factor- 4.54 X 10^8 μg/ lbs) X (Conversion Factor- 1.08 X 10^{-3} ft^2 / cm^2)].

[4] = Dose = [ISR X (Conversion factor- 0.001 mg/μg) X (Transfer Coefficient-Tc, for adults = 16,700 cm^2/hr, and for toddlers = 6,000 cm^2/hr) X (Duration, for hard surfaces-4hours, and carpet surfaces-8hours)] / BW, for adults = 70 kg, and for toddlers = 15 kg.
[a] = For only 10% dermal contact of treated surfaces, reduce the Tc by 0.1. For only 25% dermal contact of treated surfaces, reduce the Tc by 0.25.

[5] = MOE = Short-term Dermal NOAEL (0.25 mg/kg/day) / Dermal Dose (mg/kg/day).

MRID #443488-06

This study titled, Risk Assessment For Indoor Diazinon Uses, does not provide any chemical specific data for diazinon. This study is based on an evaluation of potential risk associated with applicator exposure and post-application exposure resulting from the indoor residential and greenhouse uses of diazinon.

Risk Assessments:

Occupational Exposures (Note: there are only handler scenarios, and no post-application exposure scenarios for workers)

Risk associated with dermal and inhalation exposure to Pest Control Operators (PCOs) during indoor applications. Estimates of potential exposure to diazinon during indoor application of diazinon were determined using data from Pesticide Handler's Exposure Database (PHED) and a biological monitoring study conducted by the University of Texas School of Public Health (Hayes et al., 1980). Details of the derivation of these exposure estimates are provided in Study No. 154-97, ABR-97031.

Dermal exposure resulting from PCO'S's indoor applications of diazinon based on PHED was 2,815 µg/lb.ai. for a PCO'S wearing long pants, long sleeve shirt and gloves. The registrant assumes dermal absorption is 3.85% (based on a 24 hour exposure study by Wester et al. 1993), which equates the 2,815 µg/lb. a.i.. to 108 µg/lb. a.i.. In this risk assessment, the registrant also uses a different Short-term dermal NOAEL of 1 mg/kg/day (the Agency's Short-term dermal NOAEL is 0.25 mg/kg/day). The registrant's calculated dermal dose for a body weight of 70kg, is 19 µg/kg/day. The Agency's calculated dose, based on the same body weight but a 100 percent dermal absorption, is 518.8 µg/kg/day [***this equates to a MOE = (0.25 mg/kg/day/ 0.519 mg/kg/day) = 0.48***].

The registrant has calculated their own inhalation exposure risk assessments for PCO handlers, using the same biological monitoring data obtained from the previous mentioned study above, MRID No. 443488-01. However the registrant (Inhalation NOAEL of 2.5 mg/kg/day) uses a different inhalation toxicological endpoint than the Agency (LOAEL = 0.026 mg/kg/day). The registrant's and the Agency's risk assessments are based on the biological monitoring data and

are presented below:

Inhalation exposure resulting from PCO'S indoor applications of diazinon based on PHED was 32.2 µg/lb.ai. for a PCO'S wearing long pants, long sleeve shirt and gloves. The registrant assumes an inhalation absorption correction factor of 100 % . In this risk assessment, the registrant also used a different Inhalation NOAEL of 2.5 mg/kg/day from the acute oral study of Meyer, 1997 (the Agency's Inhalation LOAEL is 0.026 mg/kg/day, for all time periods). The registrant's calculated inhalation dose for a body weight of 70kg, an average breathing volume of 1.7 m^3/hr., and the geometric mean air concentration of 3.8 µg/m^3, is calculated as follows: [(8 hr/day * 1.7 m^3/hr * 3.8 µg/m^3)/ 70kg] = 0.74 µg/kg/day. The Agency's calculated dose, is based on the same parameters and also equal to 0.74 µg/kg/day [***this equates to a MOE = (0.026 mg/kg/day/ 0.00074 mg/kg/day) = 35***].

Non-Occupational Residential Exposures (Note: exposure scenarios are only post-application when PCOs apply the pesticide)

Dermal exposure was not assessed by the registrant.

The registrant has calculated their own inhalation exposure risk assessments for an adult and a toddler, using the same monitoring data obtained from the previous mentioned study above, MRID No. 443488-01. However the registrant (Inhalation NOAEL of 2.5 mg/kg/day) uses a different inhalation toxicological endpoint than the Agency (LOAEL = 0.026 mg/kg/day). The registrant's and the Agency's risk assessments are based on the biological monitoring data and are presented below:

Inhalation exposure resulting from PCO'S indoor applications of diazinon based on US EPA's Screening Level Consumer Inhalation Exposure Software (SCIES) model and the Non-occupational Pesticide Exposure Study (NOPES). Based on the monitoring data from three monitoring studies, an average indoor air concentration of 38µg/m^3 represents the indoor air concentration of diazinon during the first 24 hours after indoor application. The registrant assumes an inhalation absorption correction factor of 100 % . In this risk assessment, the registrant also used a different Inhalation NOAEL of 2.5 mg/kg/day from the acute oral study of Meyer, 1997 (the Agency's Inhalation LOAEL is 0.026 mg/kg/day, for all time frequencies). The registrant's calculated inhalation dose for a body weight of 70kg, an average breathing volume of 15.2 m^3/day., and an average air concentration of 38 µg/m^3, is calculated as follows: [(15.2 m^3/day * 38 µg/m^3)/ 70kg] = 8.5 µg/kg/day for an adult. For a toddler, maximum inhalation exposure during the first 24 hours after application is calculated as follows: [(8.5 m^3/day * 38 µg/m^3)/ 15kg] = 22 µg/kg/day .

The **Registrant's** calculated doses for adults and toddlers, are based on the same parameters and equal to 8.5 µg/kg/day for adults and 22 µg/kg/day for toddlers, but a different toxicological inhalation endpoint- NOAEL= 2.5 mg/kg/day [***this equates to inhalation MOEs of*** *(2.5 mg/kg/day/ 0.0085 mg/kg/day)* ***290- for adults and*** *(2.5 mg/kg/day/ 0.022 mg/kg/day)* ***110 for toddlers***.].

The **Agency's** calculated doses for adults and toddlers, are based on the same parameters and equal to 8.5 µg/kg/day for adults and 22 µg/kg/day for toddlers, but a different toxicological inhalation endpoint- LOAEL= 0.026 mg/kg/day [***this equates to inhalation MOEs of*** *(0.026 mg/kg/day/ 0.0085 mg/kg/day****) 3.1 for adults and*** *(0.026 mg/kg/day/ 0.022 mg/kg/day)* ***1.2 for toddlers***.].

(g). Incident Reports

HED concludes that the majority of the reported incidents of diazinon poisoning occur in the home. Incident data taken from the "Review of Diazinon Incident Reports" (HED memorandum from J. Blondell, 7/98 to T. Leighton) are summarized below. Detailed descriptions of 860 cases submitted to the California Pesticide Illness Surveillance Program (1982-1995) constituting the most recent incident information on diazinon poisonings were summarized and reviewed for this risk assessment. These data indicate that in 521 of these cases, diazinon was used alone and was judged to be responsible for the health effects reported. Only cases with a definite, probable, or possible relationship were reviewed. Diazinon ranked 5th as a cause of systemic poisoning in California from 1990 through 1994. Table 12 presents the types of illnesses reported by year.

Table 12. Cases Due to Diazinon Exposure in California Reported by Type of Illness and Year, 1982-1995

Year	Illness Type					
	Systemic[a]	Eye	Skin	Resp	Combination[b]	Total
1982	41	7	-	-	-	48
1983	40	8	4	-	-	52
1984	28	7	3	-	-	38
1985	22	5	-	-	1	28
1986	39	5	2	-	-	46
1987	24	6	2	-	-	32
1988	45	6	3	-	-	54
1989	23	6	-	2	-	31
1990	57	4	2	4	1	68
1991	15	4	3	1	2	25
1992	15	3	3	2	1	24
1993	19	4	2	-	-	25
1994	19	3	1	-	-	23
1995	17	4	2	3	1	27
Total	404	72	27	12	6	521

[a] Category includes cases where skin, eye, or respiratory effects were also reported.
[b] Category includes combined irritative effects to eye, skin, and respiratory system.

Of the total number of diazinon incidents reported (521): 404 persons had systemic illnesses or

77.5% of 521 persons, 72 persons had eye illnesses or 13.8%, and only 5% of the cases involve skin injuries or illnesses.

Non-occupational categories accounted for just over half of the total cases and 60% of the systemic cases. Thirty percent of the non-occupational cases resulted from residues left from structural applications. By far the majority of these cases occurred when occupants reentered a structure that had just been sprayed. One of the most serious cases of this type involve 35 people who got sick when a carpet was improperly treated. Bystanders were present during the application and affected in at least 20 of these cases. There were even a few cases where the outside of a building was treated and people inside claimed exposure and illness.

Nearly half of the diazinon exposures reported in California involve workers, mostly in agricultural settings. Those who apply diazinon by hand were at greater risk than any other category, accounting for 38% of the occupational categories. This is also the category responsible for over one-half of the adverse effects to the eyes. Drift exposures and persons handling product in transport or in warehouses combined to account for over a quarter of the remaining occupational cases. Detailed review of the occupational cases found that lack of protective equipment was involved in at least 19 incidents. Equipment failure (e.g., hose breaks) was a factor in at least 26 cases. And inadequate precautions when cleaning or maintaining equipment were involved in at least 12 cases. Earlier summaries prepared by California for the years 1975 through 1982 examined all pesticide illnesses involving workers exposed to drift or residue indoors (CDFA 1976-1982). Of the 471 systemic illnesses reported during this six year time period, 123 (26%) were due to diazinon, more than for any other pesticide. In 1979, 57 workers were affected in a single incident when they reentered their offices which had not been adequately ventilated.

A report of all hospitalized cases in California for 1982 through 1994 ranked diazinon first as the leading cause of hospitalization. However, a third of these cases were attempted suicides or homicides. Among the accidental hospitalized cases most occurred among homeowners who misused the product or left it within the reach of very young children. Among the occupational cases that were hospitalized there were four applicators, three of whom were applying the product by hand.

Data from previous years incident reports indicate that diazinon was the 6th leading cause of pesticide related deaths for the years 1961, 1969, 1973, and 1974. Diazinon averaged 2.5 deaths per year during the four survey years and accounted for 3% of the total deaths. Intentional ingestion of diazinon was excluded from these figures. From 1974 to 1976, a sampling of 12% of hospitals nationwide was conducted and revealed that during this period diazinon was estimated to have been the cause of 88 hospitalizations per year and accounted for 3% of the hospitalizations. Of these 88 hospitalizations per year, 12% were related to occupational exposures, 61% to non-occupational and home uses, 24% to intentional ingestion, and 3% from unknown causes.

Another survey of hospitals nationwide conducted from 1977 to 1982 to estimate pesticide related hospitalizations ranked diazinon first in pesticide-related poisoning incidents. Diazinon

accounted for 5.6% of the hospitalizations/incidents. Ninety-one percent of the diazinon related exposures requiring hospitalization occurred non-occupationally. A 1984 survey of hospital emergency room cases related to pesticide poisonings indicated that in 2% of the cases diazinon was implicated as the cause, and of the diazinon poisonings reported, 88% of the exposures occurred in the home.